INDIANAPOLIS JUN 16 1900 PUBLIC LIBRARY

AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 23 — NEW YORK AND LONDON — NUMBER 24

Published at 218 William St., New York,
Every Thursday by the

American Machinist Press.

[INCORPORATED.]

JOHN A. HILL, President and Treasurer.
A. LEIGHTON DONNELL, Sec'y.

Also published at 34 Norfolk St., Strand, London, W. C.,
Every Saturday.

FRED J. MILLER, Editor.

FRANK RICHARDS,
F. A. HALSEY,
EDWARD P. BUFFET, } Associate Editors.

Representatives of Business Department.

ANGUS BALLARD, for New England.
JOHN MCGHIE, for Middle States.
WILLIAM R. WALLIS, for the West.

Correspondence on mechanical subjects solicited. Name and address must always be given—not necessarily for publication.

Address all business communications to the American Machinist Press. Matter for reading columns may be addressed to the Editor.

Subscribers can have address changed at will. Give old and new addresses. Date on wrapper denotes end of month in which subscription expires.

Subscription Price:

$3 per year in advance, postage paid, in North America.
$4 per year in foreign countries, postage prepaid.
No back numbers beyond current year.
For sale by newsdealers, generally.

AMERICAN MACHINIST CO., Ltd.,
34 Norfolk St., Strand, London, W. C.

ADPHE. JANSSENS, Ingr.,
16 Place de la République, Paris.
10 A Boulevard Barthélemy, Bruxelles.

V. LOWENER,
Copenhagen,
Representative for Denmark, Norway and Sweden.

GUSTAV DIECHMANN & SOHN,
Neue Promenade 4, Berlin,
Representatives for Germany, Austria and Holland.

Entered at New York P. O. as second-class mail matter.

Cable address, "MACHINIST," N. Y.
Lieber's and A B C Codes.

Machinery Trade Prospects.

There is, no doubt, a state of nervousness among American machinery builders over the business prospect. The great trade barometer, iron, after a sky-rocket rise, is now falling, and other products, among which is machinery, are showing more or less sympathy with it.

It is an unfortunate fact that when prices are advancing buyers are disposed to anticipate their wants and to file orders in advance of needs in order to get in ahead of further advances. On the contrary, when prices are receding, the opposite tendency shows itself, and buyers put off purchases as much as possible and buy for immediate needs only. Both upward and downward tendencies are thus accentuated and magnified. Last year we saw the first action in full swing, and we are now witnessing the second. Last year's prices of iron were undoubtedly too high, and the present reaction was inevitable. We do not, however, believe it to be any more than a reaction, and there is no reason to be alarmed about it. The basis of the country's prosperity is too broad and deep for any pronounced slump, and, in fact, so far as the machine-tool trade is concerned, we are convinced that there are elements in the situation which are in the highest degree satisfactory.

Among these is the conclusion, now assured, of the South African war. However the sympathies of the individual may lie, there can be no doubt that the conclusion is in the highest degree favorable to business interests, and great as have been the developments of that country in the recent past, they are, in our opinion, but the beginning of what is to come. The development which has taken place has been in spite of the war cloud which has hung over the country, and the hostilty of the ruling race which has had to be considered. With these removed, developments will proceed by leaps and bounds, with corresponding demand for mining and other machinery. Much of this will of course be supplied from Europe, but wherever it comes from, it cannot be made without machine tools, and in our judgment American machine tool makers should not fail to consider the situation as most favorable to an increase of their trade in Europe. Furthermore, mines breed machine shops. In addition to repair shops owned by the mines, there can be no doubt that the growth of the mining industry in the Transvaal will lead to the establishment there of works for the construction of machinery at home. It was thus that many of our own largest machine works were built up, and the greatly increased distances to be covered can only accentuate the movement in South Africa. Large machinery will, of course, continue to be imported, but the great advantage of having the maker at the buyer's elbow will inevitably lead to many minor wants being supplied by home enterprise, and how great this market is is known to those only who are acquainted with mining operations.

The result of this must be the creation of a market for machine tools, and the conditions of that market are altogether favorable for sales of American products. American mining machinery is used in the Transvaal to a much greater extent than is realized by most American manufacturers, and in many lines it is preferred. This large amount of American mining machinery has acquainted the operators with our mechanical products and has fairly paved the way for the sale of other kinds of machinery, and in addition to this is the fact that the mining operations of the country are largely in the charge of American engineers. While local conditions have brought out much that is germane to the soil, it is nevertheless true that the mining engineering methods of the country are more closely allied to our own than to those of any other country. All of these conditions have given American mechanical methods a prestige which should be utilized by American machine tool builders. Will some of them take the hint?

German-American Trade Misunderstandings.

One of the best consular reports bearing upon machinery trade that has been received by the State Department for a long time is a communication from Consul-General Frank H. Mason, at Berlin, on "German-American Trade Misunderstandings." It occupies eleven pages of the reports. A synopsis as nearly complete as possible is here given:

The mutual distrust and aversion in business relations existing between Germans and Americans are largely the result of reciprocal ignorance. Even men of such training and intelligence as the delegates to the commercial exposition at Philadelphia bring back from their visits to the United States ideas so changed that they become known as the "Germans who have discovered America." On the other hand, a large proportion of the Americans visiting Germany expect to find travel, rents and cost of living cheaper there than at home, while in all branches of manufacture, except those in which hand labor is the principal element, they regard the Fatherland as far behind the United States.

In the many differences between the two nations, Americans are prone to regard their own ways as the best. Frequently they may be right—but not always. The trouble lies not in the inferiority of either, however, so much as in the fact that their dissimilarity leads to doing business at cross purposes. The difficulties that arise from not knowing and allowing for individual customs are illustrated in dealings with electrical machinery. Three years ago, and even later, there was a promising field for American dynamos, motors and other electrical machinery, since electrical development in Germany had taken on a new impetus,

business was prosperous, the three or four large German works were crowded and prices ruled higher than in America. Many of the resulting purchases in the United States proved unsatisfactory because of misunderstandings. For instance, the Germans rated horse-power according to average normal capacity instead of maximum capacity, as commonly done here, and when they ordered a 20 horse-power motor they would find it too small for their work. To the complaints that might result, the manufacturer would reply that the machine was a 20 horse-power when it left his factory. Again, in German practice, an electrical machine is considered too hot if the hand cannot rest upon it in comfort, while in America it would be worked up to 20 or 30 degrees of a temperature that would char cotton insulating materials. The American machine for a given capacity is lighter and cheaper, but it will not perform the work expected of it without being crowded beyond European ideas. Moreover, in Germany the use of accumulators in lighting plants, particularly in isolated and small municipal ones, is very general, and a 110-volt generator is expected to be able to run satisfactorily up to 150 to 160 volts early in the afternoon for charging these accumulators. In the use of rheostats also there is a difference of practice. The Germans do not start their motors so rapidly as we do, and those rheostats which have been sent to Germany marked that they will carry the current for only 15 seconds do not conform to the practice of that country. A large stock of American rheostats was thrown back upon the Berlin dealer by customers who ordered them according to German ratings and found them inadequate.

Another obstacle to the success of American electrical manufacturers—which savors of the Chinese rather than of the German market, one would think—is the plain finish they give to their machines. The German maker decorates his with elaborate furbishing.

Finally, our system of discounts is too abstruse even for the metaphysical German, who recoils in despair from a description of an American article in inches, pounds and dollars offered at "33⅓ and 10 and 5 per cent. from list, f.o.b. New York."

The writer goes on to state some of the fundamental principles which apply to trade with Germany. First, the would-be exporter to that country must be willing to go to some trouble and expense to get and hold his market. If he only wants it as a dumping ground for his shopworn or surplus stock during dull times at home, the experiment would best be left untried. The reputation of American bicycles in Germany, built up by a few first-class makers, was ruined by the cheap, low-grade wheels gathered from bankrupt stocks in the United States and exported by brokers who never expected to place another order in Germany.

Second, it is the seller who will have to make an effort to reach the buyer. This he may do through (1) a general importing house, (2) a special agency for American goods exclusively, (3) a branch house of his own. To attempt to carry on business with the small German dealers by mail, the favorite scheme of inexperienced exporters, is futile. Some time ago a promising demand for American shoes was lost because the manufacturers adopted this method, were negligent in filling orders, and the customers could not replenish stocks in time. Some of the greatest successes have been those of concerns like the Singer Sewing Machine Company and makers of cash registers, typewriters, graphophones and phonographs and certain bicycle firms, which have branch houses in European countries and conduct their trade by practically the same methods as at home. But others have succeeded, particularly in lines of machinery and patented articles, by giving their trade to large and responsible foreign importing firms. When agencies are given the manufacturers ought to be faithful to them. Some time ago an American file maker sent out a representative, who frequently established two or three "sole agencies" in the same town, the firms so privileged having to place an immediate order, and agreeing to keep a full line of the goods in stock. The truth soon became known, and the salesmen, being unable all to sell to retail dealers, went into factories and machine shops, sold files at factory prices by the dozen, half dozen, or single piece—anything to get rid of their stock—with the result that the reputation of the manufacturer as a business man was permanently damaged, and the general retail price of American files broken down. In another case, after a high-class German importing firm, working under a contract renewed yearly, had built up a reputation for a superior brand of American twist drills, a rival firm induced the manufacturer to give it the exclusive agency over the head of the former one. The original importer then took up the best German drill he could find and held his trade with the reputation gained by the American drill. In this case there may have been no violation of any agreement, but—did the move pay?

The fault, however, is not always on the American side. In some instances German importers have obtained exclusive control of an American article merely to keep it quiet while they have supplied the market with one of another make. To guard against such chicaneries a responsible representative of the manufacturer ought to visit Germany and make the personal acquaintance of the would-be agent at the start.

Discounts, if they must needs exist at all, should be simple ones. Costs of packing would better be included in the price. Give dates and full particulars as to patents. State where and by whom previous sales of the article in Germany have been made. Pack in as small space as possible, since ocean freights, unlike those by railroad, are determined more by bulk than weight. As these freights are variable, and are more easily ascertained on this side of the water, name prices, if possible, c. i. f. (costs, insurance and freight), instead of f. o. b., New York, or other port. If catalogs in German cannot be supplied from home, furnish the agent with cuts or photos and a fair allowance for printing and advertising. Be sure to prepay letters. Often a quarter or a third of an entire mail to a European consulate will consist of letters with 5 to 20 cents fine to pay before delivery. The consul accepts them and pays the penalty—from official funds—but private parties sometimes prefer to let the letters go.

More possible American trade with European countries has been lost through timidity as to credits than for any other cause. Manufacturers in Germany, France and Belgium sell to the local trade against thirty, sixty or ninety days' acceptances. In Russia they give three, six, nine, or even twelve months' credit, with suitable advances in price to allow for interest. An "acceptance" in this sense is a draft on a prescribed bank, usually in the buyer's neighborhood; it is sent with the goods to the buyer, who signs it, and must pay it or go into bankruptcy. These acceptances may be discounted by any bank or person of good credit, and when so used have practically the character of cash payments. American firms having reliable connections abroad can therefore safely avail themselves of such drafts against acceptances, which could be used by American banks in settlements with their European connections.

As a final word of encouragement it may be said that German consumers have little or no prejudice in favor of home-made goods, so that the success of an imported article depends directly upon its quality and the price and terms at which it is offered to the trade.

Inquiry for Machinery.

(124) Wanted names of manufacturers of machines suitable for the preparation and cutting of rubber threads, such as are used in the manufacture of elastics.

In the State of Indiana there is a law which has not been long in operation, and known as the Weekly Wage Law. It requires corporations doing business in the State to pay their employees every week and upon an appointed day. The State Factory Inspector is required to enforce the law by the necessary legal proceedings. Suits against the American Plate Glass Company, the American Tin Plate Company and the Republic Steel Company have resulted in each case in a decision sustaining in every respect the validity of the law. A case now goes to the Supreme Court of Indiana for final determination.

Commercial Review.

NEW YORK, Saturday Evening, June 9.

THE SOUTH AFRICAN OUTLOOK.

A good many eyes, European and American, are being turned upon South Africa as an incipient storm center of commercial activity now that the clouds of war have nearly rained themselves out. The outlook there is important to us, because it may show a means, direct or indirect, for disposing of the surplus output of machinery in this country. The demand created by the South African revival can hardly be very large compared with the total in this country, but if it should be equal to the difference between what we produce and what would otherwise sell it might mean to us all the difference between a stable market and one which is losing its balance.

At the beginning of the war there was an exodus from South Africa of the agents representing American machinery companies. Some of them are now spending their time in the United States or Europe and have not yet started to return. Fraser & Chalmers and the Ingersoll-Sergeant Drill Company's agents are yet spending their time in Europe and the United States. The General Electric Company's South African representative, however, started back there upon early indications of peace, and is believed to be arriving there about this time. A superintendent of one of the largest South African gold mines, Mr. Joseph P. Gazzam, who was driven out by the Boers and has been in this country, returned June 4. The Westinghouse Company's representative has just started back. The Gates Iron Works' agent, though an Englishman, is said to have remained in the Transvaal through the war.

Thousands of tons of machinery ordered before the war are now piled at Cape Town waiting to go inland when peace is restored.

German manufacturers are on the alert, for they are said to be preparing great quantities of machinery and other goods to dump into South Africa as soon as the war is over.

In regard to mining machinery, there is no urgent need of being on the scene itself at the start, for it is said that the greater part of the buying for the mines is done through their European offices. The mines are largely financed in London, Paris and Berlin, and worked under American management. American machinery is said to take precedence of all others, but the purchases of the same, when made on a large scale, are quite generally placed from Europe. The owners of the mines have studied the future as attentively as anyone else, and they have already laid plans and made inquiries looking to the improvements that must follow the end of the war. As the mines do not appear to have suffered serious damage, there is not sufficient ground for prediction that these improvements will be radical at the start. However, with the preponderance of the English in the Dutch states and their probable influx there in considerable numbers, a great deal of industrial enterprise is likely to be felt there before long.

For American machine tool builders the salient feature of the outlook seems to be a stimulation of European industry, which will increase the demand for tools in that quarter.

Mr. John Kirkland, the General Electric Company's South African agent, who recently returned there, is stated to have left with confident predictions of an excellent season's business. This company has already done a great deal of business in South Africa in mining, lighting and railway machinery.

An official of Fraser & Chalmers, Incorporated, who are among the largest builders of mining machinery, gave a few offhand views upon the situation. The outlook he pronounced a matter of problem and speculation. While apparently hopeful of a good demand in the Transvaal upon restoraton of peace, he was inclined to be a little conservative in respect to the haste and magnitude of the requirements for mining machinery. He was of opinion that anyone who should go on the ground now with the idea that peace was practically restored would have to wait there several months before being able to do any business. The improvements which can be foreseen, he says, are pretty largely discounted in the way we have already mentioned, through inquiries, etc., put out by the European owners of the mines. Mining machinery deteriorates faster when not in use than when it is kept running, yet that in the Rand mines has probably not undergone serious damage. The more ponderous portions can have suffered little harm. It was stated also that there is a good demand for mining machinery elsewhere than South Africa. Mexican conditions are excellent, and there is a good deal doing in our own country.

The Ingersoll-Sergeant Drill Company seems to be looking forward hopefully to a resumption of trade with South Africa after the war is over and to its expansion, ultimately at least. A prominent official of that company spoke, however with some moderation, of the outlook, and called attention to the danger that there would be a rush of foreigners into the country, reactive in its tendency. He considers, also, that a country recently devastated by war is always subject to depression and that its revival is a matter of slow development.

A representative of the Rand Drill Company expressed the opinion that the character of the mining would act in the future as it has in the past to prevent booming and wildcatting. The deposits are large, of low grade, and extend to great depths. These conditions make profitable mining possible only when done upon a large scale, both financially and mechanically, and act as a heavy flywheel to steady the entire mining industry of the country.

The New York manager of a prominent water-tube boiler company, who always has something interesting to say upon market conditions, tells us that his company has been considering South African prospects rather attentively, and that he is very much encouraged at the outlook. He believes that there will be a big demand for machinery for numerous kinds of enterprises, and that it is the American product which will be bought. This is because we can make better deliveries than the English and furnish a better class of goods than the Germans or Belgians; also, because so many Americans occupy responsible engineering positions down there and will naturally look to this country for their supplies.

In the same conversation the domestic situation was mentioned, and the gentleman speaking remarked that he was a thorough optimist over present conditions. The closing down of the mills of the American Wire and Steel Company has been a splendid thing for business, as it has punctured the inflated schemes that were circulating about and has put trade upon a steady basis. In the last two months there has been, within the scope of his observation, a marked improvement in demand for boilers, which he attributes to the limbering up of industrial enterprises now that prices of materials have gotten down to a basis where they may reasonably stay.

CHICAGO MACHINERY MARKET.

Varying reports concerning the state of the machinery trade seem to be pretty well reconciled in the general statement that makers of the smaller and less expensive tools have now caught up with their orders and are looking for business, whereas the builders of the larger machines and of special machinery still have an abundance of work before them. For the medium sized standard tools, or smaller, the market is almost quiet. Quite a fair business is being closed, but output has so largely increased that demand does not fit supply, especially for those grades upon which the lesser care is taken, and which, accordingly, are turned out in the larger quantities.

There is a distinct tendency towards special machinery again, and many manufacturers are turning to this source of trade for their future activities. Rudolphi & Krummel are now devoting attention to the production of special machines to be used in the canning and in the electrical industries. Hill, Clarke & Co. have closed an order for $8,000 worth of special machinery for use in Chicago. The Marshall & Huschart Machinery Company have sold a shop outfit to a new company which is about to build a machine for wrapping small packages.

such as chewing gum, soap, etc., thus displacing hand labor very largely.

Foreign trade shows, if not growth, at least a continuance of former activity. McDowell, Stocker & Co. have sold to a mining machinery manufacturer in England a bill of machinery and shop supplies amounting to about $6,000. From other sources there are plain indications of a revival of machinery demand from the mining regions of South Africa.

While trade is fairly good at Chicago, it is better from the country. The mail department is superior to the selling floor. Some complaints are heard that the large local shops which had contracts on hand when the machinists' strike occurred, and which had to yield the business temporarily to machine shops located outside of the city, are having difficulty in getting back their loaned trade; and, moreover, that they are experiencing even greater trouble in getting the old contracts renewed or others in their place. In other words, other things being equal, the country shop is given the preference, because of conjectured greater freedom from labor complications.

Railroad shops are good buyers at present. The West continues to call for mining machinery in large quantities. Trade is slackening down somewhat as the summer grows in length, but large machine tool interests say that 1900 promises to be fully as good a year as was the banner year—1899.

CINCINNATI REPORT.

Local conditions in the machinery and machine tool trade of Cincinnati augur well for a continuance of the past and present market activity. Inquiry of both manufacturers and jobbers indicates that there is no perceptible diminution of their trade and output, and only among the smaller manufacturers has there been any perceptible slump. From this it is pretty safe to assume that the summer will be bridged over with good returns for all. Many orders are booked ahead, which will require a month or so to fill. At the offices of the E. A. Kinsey Company here it is learned that great activity exists, more especially marked in the mining machinery department. The head of this department states that it will be impossible to catch up on orders for some months to come from present appearances. The demand for power machinery in electric lines is also active. Thomas S. Stevens, now representing C. W. Burton, Griffiths & Co., of London, England, dealers in English and American tools, was in the city a few days this week. Mr. Stevens has made during his late sojourn in England a pretty general investigation of trade conditions. He says that the machine tool trade is good in England on heavy tools, and he finds that they compare favorably as to efficiency and quality with the American product, but it is in the line of small tools and smaller machinery that the English manufacturers are inferior. In character, Mr. Stevens says, the English product is very much inferior to that of the American. American goods, he says, are gradually getting a firm foothold among English buyers. One firm increased their business from £750 to £5,000 in one year.

In woodworking machinery lines there is also a well marked activity. Thomas P. Egan, president of the J. A. Fay & Egan Company, has just left for a three months' tour of Europe. During his trip he will spend a few days with prominent manufacturers and dealers who have visited the works in Cincinnati. The works of the American Rolling Mill Company at Middletown, Ohio, are being rapidly established, and it is thought operations may be commenced within the course of five or six weeks.

The larger electric machine making concerns are very busy with orders, and in the main for the equipment of large establishments. Generators and motors have been ordered of the Triumph Electric Company for use in operating coal mining machinery; also for a big car and foundry company in Kansas City; for furnishing power in the big Globe-Wernicke Company's plant in Norwood; for operating a new electric line between Montgomery and Kanawha, W. Va.; for furnishing power for the Cole Estate Building in St. Louis, and two belted generators for a large business block in Chicago.

MISCELLANEOUS.

Mr. V. A. Kajevnikoff, chief mechanical engineer of the Chinese Eastern Railway, of the Trans-Siberian route, is in this city making additional purchases for the road. It is understood that machine tools of various sorts and air compressors are included among the orders placed on his American trip.

The demand for pneumatic tools is one of the most obvious signs of the commercial times. We have frequently mentioned what was being done in this line in the West. A report has just been received from the Philadelphia Pneumatic Tool Company that the call for its tools is rapidly increasing, and that since the beginning of this year it has more than doubled the capacity of its shops. Its chipping and calking hammers seem to be particularly in demand, large orders having recently been received from the Pennsylvania Steel Company, Baldwin Locomotive Works, Brown & Sharpe Manufacturing Company, Ingersoll-Sergeant Drill Company, the Bigelow Company, and many other representative concerns. It is said that in all cases these hammers were adopted after severe competitive tests. The company has established agencies in the leading cities of Europe, and also in Japan.

The Chicago Pneumatic Tool Company has just shipped a complete compressed air plant, including a large electrically driven air compressor, pneumatic hammers, drills, shell riveters, etc., for the Kawasaki Dock Yards, Japan. Mr. J. W. Duntley has returned from Europe with fresh orders numbering 1,000 tools. It may be remembered that a contract for about that number of tools for the Russian navy yards was closed by the company not long ago. A British trade paper says British tool makers will be disposed to inquire why this company secured it.

The Portuguese Government now admits materials for the repair of ships free of duty at the port of Lisbon. The favoring of that port is because it is the only one having dry docks and facilities likely to attract foreign vessels.

Quotations.

NEW YORK, MONDAY MORNING,
June 11, 1900.

Iron—American Pig, tidewater delivery:—

Pennsylvania Irons:	
No. 1 X foundry	$20 50 @ $21 00
No. 2 X foundry	19 50 @ 20 00
No. 2 plain	17 50 @ 18 00
Alabama Irons:	
No. 1 foundry	22 00 @ 22 25
No. 2 foundry	21 00 @ 21 25
No. 3 foundry	20 00 @ 20 25
No. 1 soft	22 00 @ 22 25
No. 2 soft	21 00 @ 21 25
Foundry forge	18 75 @ 19 25

Bar Iron—Base sizes—The price on dock is 1.70 @ 1.80c. for good refined brands and 2.15c. upward for same from store.

Tool Steel—Base sizes—Good standard quality, 7 @ 8c., with a cheaper grade. 6½.; extra grades, 10 @ 14c.; special grades, 16c. and upward.

Machinery Steel — Base sizes — From store, 2.40 @ 2.50c.

Cold Rolled Steel Shafting—Base sizes —From store, 3½ @ 3¾c.

Copper—In carloads—Lake Superior ingot, 16⅜ @ 16½c.; electrolytic, 16⅛ @ 16¼c.; casting, 16⅛c.

Pig Tin—In 5 and 10-ton lots brokers quote 30c. f. o. b., but a lot has been offered on metal exchange at 29.65c. (not f. o. b.).

Pig Lead—3⅞c. in wholesale lots, carloads, .02½ @ .05c. extra.

Spelter—Prime Western, 4⅜ @ 4½c., New York delivery.

Antimony — Cookson's, 10¾ @ 11c.; Hallett's, 9⅝c.; United States, 9⅜ @ 9½c.

Lard Oil—Prime City, 58c. in lots of one to five barrels.

The "Automatic Turret Lathe Company" mentioned in a Wilmington note in "American Machinist" No. 22 should have read "American Turret Lathe Company." The E. W. Bliss Company, whose catalog of the Bliss-Heath vacuum or atmospheric pumping engine was noticed in the "American Machinist" No. 23, is located in Brooklyn, N. Y., not Boston, Mass.

The Paris Exposition—V.

EDITORIAL CORRESPONDENCE.

FORMAL OPENING OF THE VINCENNES MACHINERY BUILDING.

An event of special interest to Americans here was the formal opening of the United States Machinery Building, which took place on May 15. Herculean efforts had been put forth to have the building and exhibits as nearly ready as possible, and although the interior did not look too promising early in the morning, by half-past three, when the crowd entered, nearly everything had the appearance of practical completion, although the practiced eye could discern here and there evidences of preparation for the opening ceremony rather than for the actual serious exhibition of the machinery.

At 2 P. M. the Seine boat "Le Touriste," left the Pont d'Iéna (the bridge directly in front of the Eiffel tower), gaily decorated with American and French flags and bunting, and having on board about 100 invited guests, with Sousa's band. In front of the recently dedicated United States building on the Quai d'Orsay, the boat halted while the band played the "Star Spangled Banner" and "Yankee Doodle," to an accompaniment of waving hats and cheers, and then proceeded up the river to the landing place called Ivry; the trip consuming just three-quarters of an hour. Carriages which were in waiting conveyed the party to the park and before the westward front of the building, where a bandstand had been erected and a large number of interested people had gathered. Director of Machinery Drake in a few words presented the building to United States Commissioner Peck, saying, as he did so, that special credit for the success of the Vincennes enterprise was due to those American firms which by their hearty co-operation, energy and perseverance under specially trying circumstances, had created the building and prepared and installed the exhibits. He specially mentioned, in this connection, the Berlin Iron Bridge Company, the Ball Engine Company and the Climax Boiler Company.

In responding, Commissioner General Peck said that the Vincennes machinery building was the result of Mr. Drake's conception of the idea for it; that it had been a happy solution of a difficulty that had presented itself with regard to securing adequate space at the Champ de Mars—a difficulty which, although the utmost efforts had been put forward to overcome it, had proven insurmountable, and for a time had seemed likely to absolutely prevent anything like an adequate or representative showing of American machinery. General Horace T. Porter, United States Ambassador to France, followed in a few well-chosen words of eulogy for American industries generally, and expressed his belief that the American machinery exhibit at Vincennes would render the spot historic, and that it would be of great benefit to American industries generally and to those of foreign countries as well.

At a signal from Mr. Drake, the whistle sounded (drowning the music of the band), the machinery started up and the United States Machinery Building was declared to be formally open to the public. Passing inside only a few machines were seen in motion. Some heavy Niles and Pond tools, driven by attached motors, were turning their spindles; the boring and turning mills of the Bullard Machine Tool Company were in motion, and several of the Brown & Sharpe Manufacturing Company's machines were actually at work; one automatic being engaged in making collar buttons from a brass rod (which collar buttons were eagerly sought for by the crowd), while a large automatic gear cutter was at work near by. This last named exhibit seemed practically completed and fully ready for critical inspection, and was the only one for which quite so much could be said. Others would have been fully completed, however, had it not been for broken promises regarding the delivery of belts and other articles needed, and which were to have been on hand, *"assurement."* Altogether, however, and considering the general state of the whole exhibition, the opening of the United States Machinery Building was generally considered to be quite successful, and a few touches here and there will leave exhibitors with no other problems than those connected with getting interested people to go out to Vincennes to see the exhibit; preceding which there must be of course the realization that only by so doing can one get much idea of what America has to show in the way of machine tools.

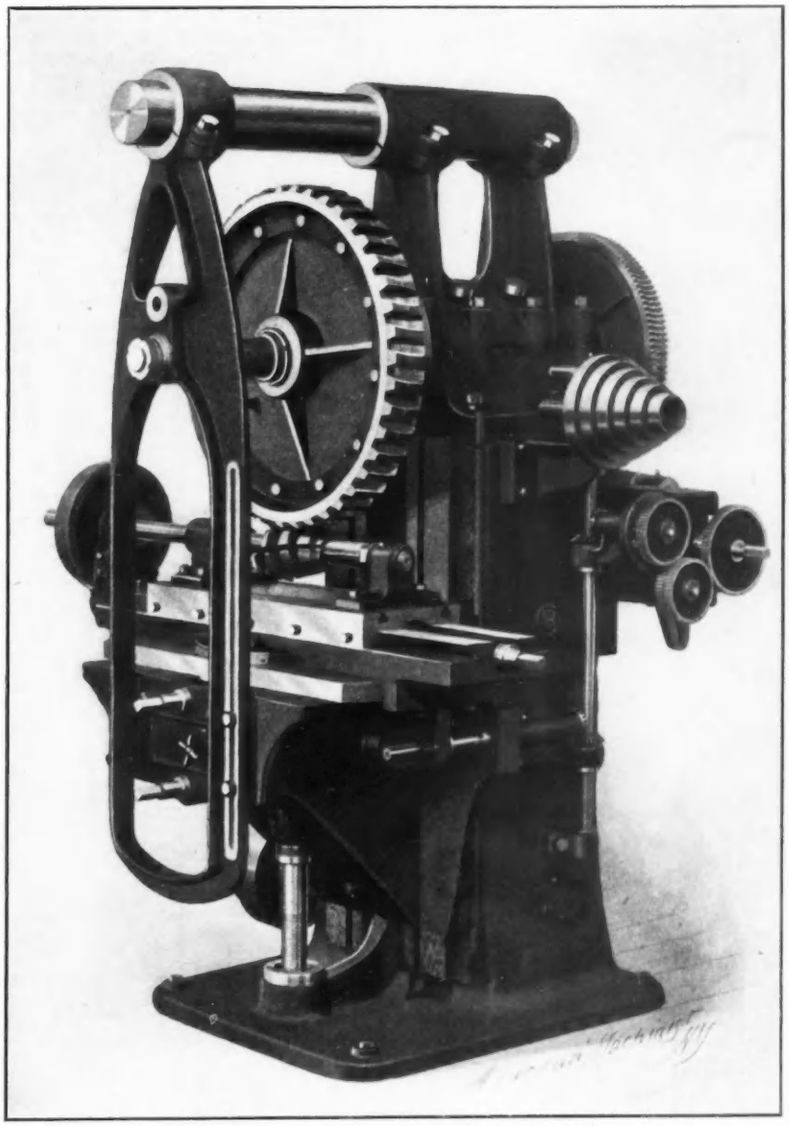


FIG. 14. REINECKER'S WORM WHEEL AND SPUR GEAR CUTTING MACHINE.

The building thus opened contains 125 distinct exhibits, which, with the passageways, occupy an area of 45,000 square feet. There is a total of 500 horse-power, and

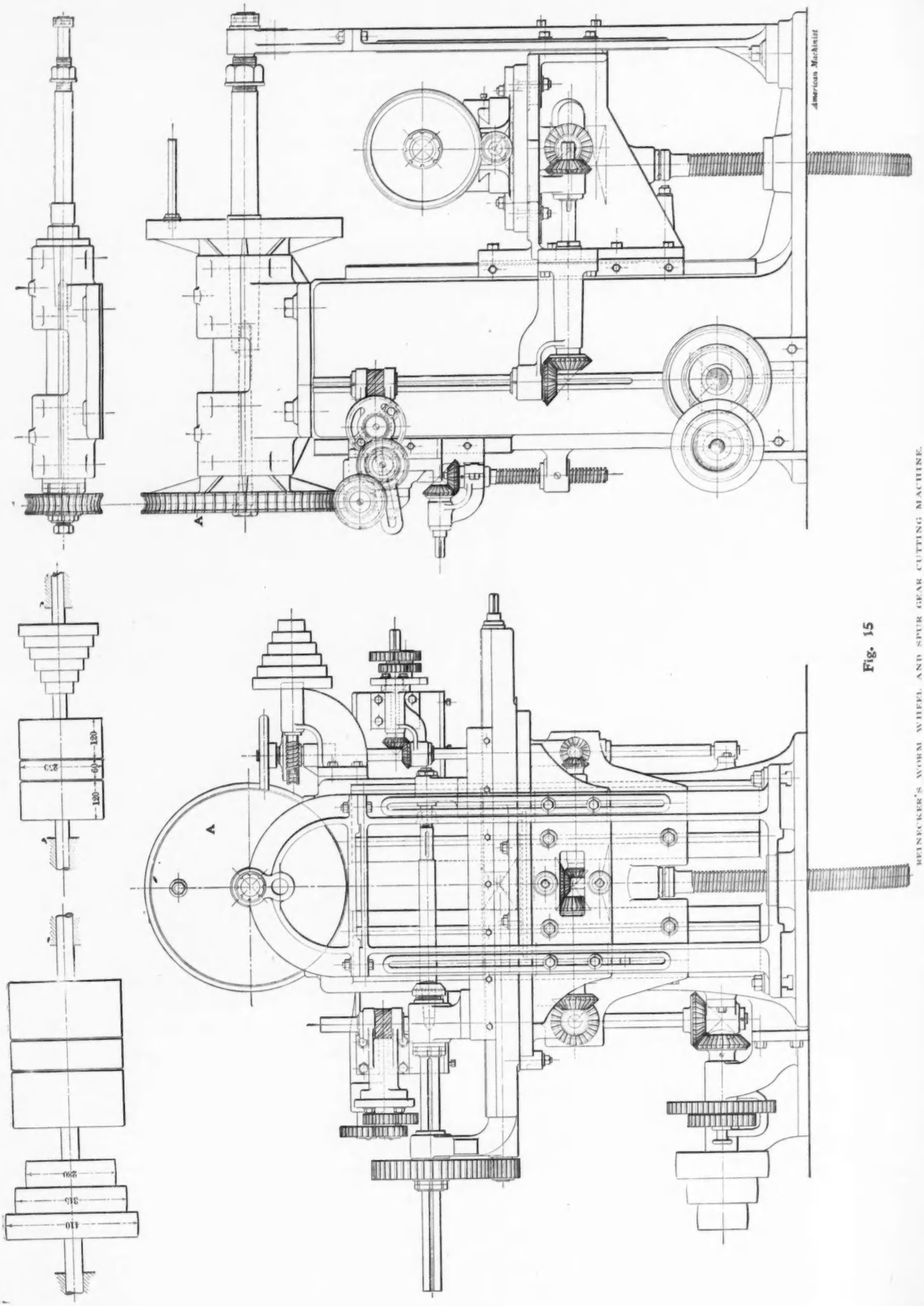


Fig. 15

REINECKER'S WORM WHEEL AND SPUR GEAR CUTTING MACHINE.

compressed air will be supplied from it to more machinery in other near-by buildings, including some of the American locomotives.

One can now go from the Champ de Mars to Vincennes by the river route without much walking, because on the 18th a trolley line was opened, by which one can go from the landing station at Pont Nationale (which is where the line of fortifications intersects the Seine) to a point very near the locomotive exhibit, from which the distance is short to the machinery building.

Among the interested spectators of the opening ceremonies was Mr. Chas. Davis, of Cincinnati, who, with his mother, has been traveling in Egypt, and is stopping in Paris for a time. He tells me his health is much improved and that they expect to reach home in October.

THE REINECKER EXHIBIT.

As I have previously explained, things are in such a state here that it is not practicable to take up the various exhibits or machines in any orderly or systematic fashion, but only to take such machines as can be gotten hold of as opportunity presents itself.

J. E. Reinecker, of Chemnitz, who, it will be remembered, made a very creditable exhibit of tools at Chicago, has an excellent exhibit here also, some of the machines being practically like those shown at Chicago, while others are new. Some of the more interesting of the new ones are herewith illustrated.

A WORM AND SPUR GEAR CUTTER.

In our issue of November 3, 1898, it will be remembered, we published an account of Reinecker's new system of cutting worm wheels, and illustrated his machines for doing the work. This system is, in brief, to use a taper hob (resembling a tap), which is set to the full depth, outside the blank and on a line tangent to it, and then fed forward while both blank and hob are rotated at the proper speeds.

The machine exhibited here for this work is of a new design, and is shown by the photograph, Fig. 14, and the drawing, Fig. 15, which make it easily understandable and render extended description unnecessary. Referring to Fig. 15, *A* is a master worm wheel by which the blank is rotated, and this is driven through the change-gears seen below, which in turn are driven in the manner indicated from the same vertical shaft from which the rotary motion for the hob is derived; this rotary motion for the hob being carried to the center of the saddle and back to the spur gears at the end of the platen, as shown. The motions for the blank and for the rotation of the hob are thus always proportioned to each other, to suit the required relation between the pitch and diameter of the wheel to be cut. The longitudinal movement of the platen, which constitutes the feed, can be of course independently variable to suit conditions, and this is provided for by the feed

FIG. 16. REINECKER'S WORM THREAD MILLING MACHINE.

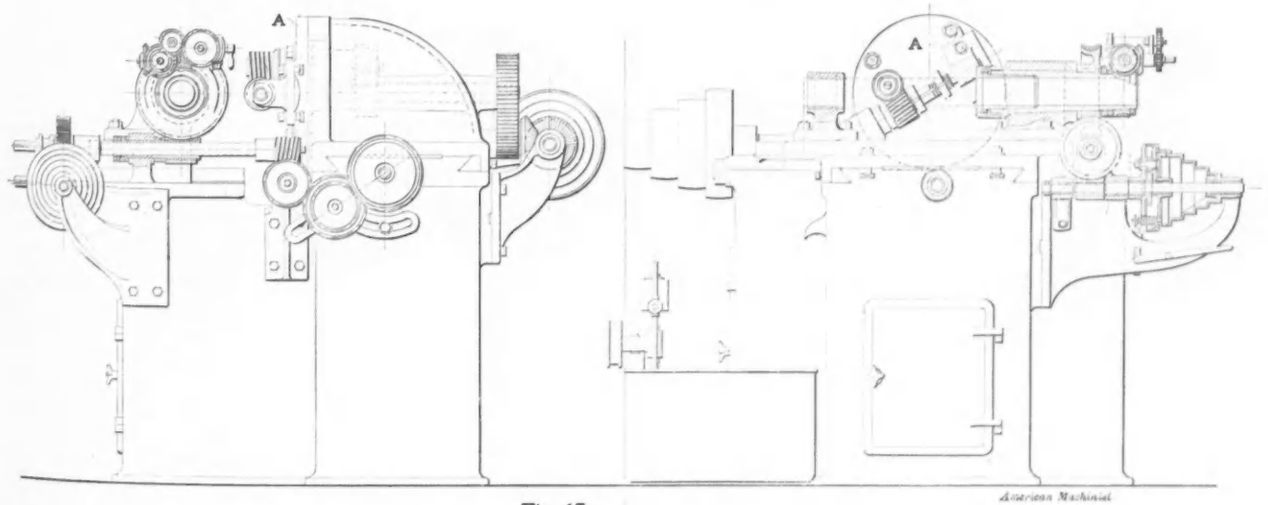


Fig. 17

REINECKER'S WORM THREAD MILLING MACHINE.

REINECKER'S WORM WHEEL AND SPUR GEAR CUTTING MACHINE.

mechanism seen at the right of the machine, which feeds the platen in the manner indicated and at the same time, by means of the change gears seen below, the feed cone adds the proper rate of rotation to the blank to compensate for the forward motion of the hob, by moving in the same direction the slide on which is mounted the worm shaft that drives the

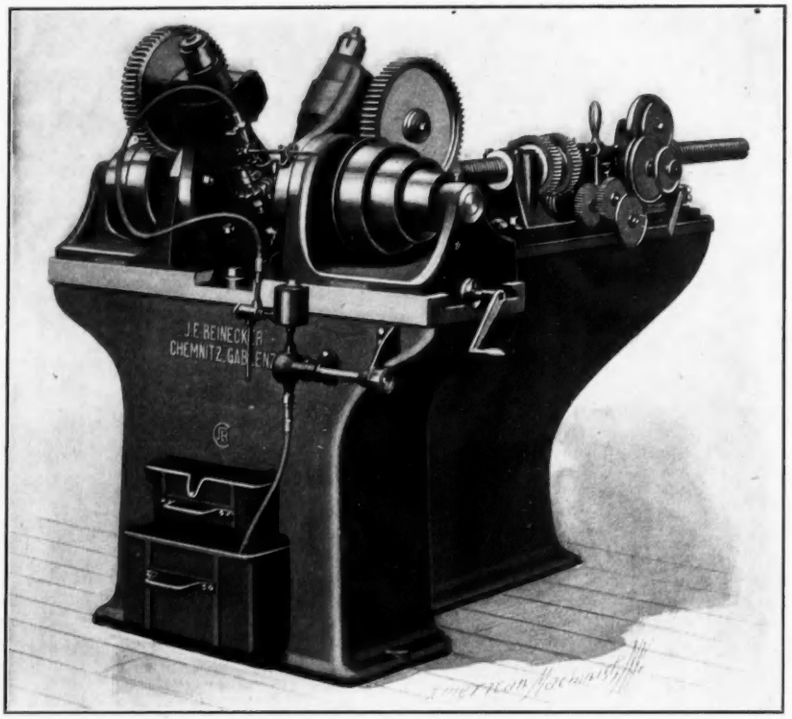


FIG. 18. REINECKER'S TWIST DRILL GROOVING MACHINE.

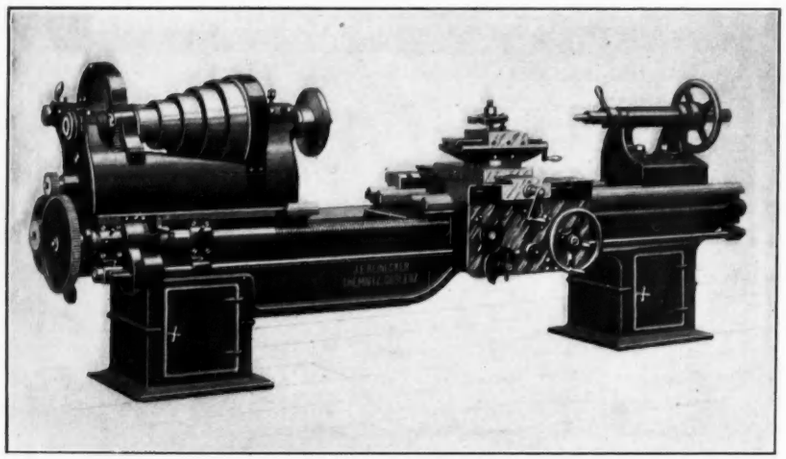


FIG. 19. REINECKER'S 300M/M, OR 23-INCH, LATHE.

master worm-wheel. In other words, both the hob and the worm are moved endwise in the same direction at rates proportioned to the ratios existing between the gear to be cut and the hob and between the master worm-wheel and its driving worm, while at the same time, by another train of mechanism, the relation between the rates of rotation of the worm and the hob is also adapted to the same compound proportion, and either set of motions is independently variable to suit the conditions of the work. Most of us will need to study the machine a little in order to fully grasp its principle, but it is interesting and will repay the study.

For spur gears I am obliged to infer its action from what seem to me to be the obvious purposes of certain features, and I conclude that for this purpose the hob is not tapered, but made in the ordinary form and fed into the work in a direction at right angles to the worm-cutting feed; i. e., by the motion of the saddle upon the knee, while at the same time the platen is set around to an angle corresponding to the angle of hob teeth or spiral. The blank being then rotated at the proper rate, the hob is rotated with it, and at the same time fed across under the face of the gear, the hob-teeth (presumably of rack tooth shape) developing the proper tooth curve for the given gear, which of course means that only one hob would be required for cutting all the different sized gears of the same pitch.

At the upper right-hand corner of Fig. 15 is a head which goes on in place of the one shown on the machine when much smaller wheels are to be cut, the worm shaft being adjustable vertically to suit either the larger or smaller master worm-wheel.

WORM-THREAD MILLING MACHINE.

The complement of the machine just described is exhibited also, and Figs. 16 and 17 give an idea of its appearance and construction. It is for milling the threads of worms. The worm to be cut is placed between centers on the platen and is milled by a cutter placed upon the arbor, which can be set at any required angle in a vertical plane to suit the angle of the worm spiral. This is done by means of the graduated plate *A*, Fig. 16, through the center of which plate the cutter-driving mechanism is carried to the worm and wheel spindle-drive.

In this case the rotary motion of the cutter is not related to anything other than the cutting conditions, but the rotation of the blank and the endwise motion of the cutter must of course be proportioned in relation to the ratio of diameter and pitch of worm. The last two motions are therefore derived from the feed cone at the right of the machine which rotates the blank by means of the two sets of worm-gearing shown; while from the same horizontal shaft, but through the medium of the train of change gears at the right, the head carrying the cutter arbor is fed along the bed at the proper rate. In the case of multiple-threaded worms, they are indexed from one thread to another by means of the smaller worm wheel seen at the right of the other one, the Reineckers having introduced here what will be remembered as a feature of their indexing mechanisms, i. e., an index wheel having only one hole in it and moved by a train of change gears to give the proper indexing with an integral number of rotations of the single-holed index wheel. For such very simple indexing as is required for multiple-threaded worms this would seem to be a totally unnecessary expense, and that a plain plate with twelve holes in a single circle or with three circles of holes having two, three and four holes, respectively, would answer every purpose. But there is much good evidence that the Reineckers understand their own market pretty thoroughly, and know the conditions under which their machines are operated, and it is safe to conclude that they can give a pretty good reason for any variation from our practice that may seem strange to us. It will be noticed that this part of the

mechanism is not the same as shown in the photograph and in the line drawing. The photograph shows the arrangement as it is exhibited here; that shown by the drawing being declared by the same genial German workman that had charge of the Reinecker exhibit at Chicago, seven years ago, to be "no good," though just why it is no good I do not know.

TWIST-DRILL GROOVING MACHINE.

At Fig. 18 is shown a twist-drill grooving machine exhibited by the same maker. The blank is shoved through a bushing horizontally by means of the large screw seen at the rear, which is fed forward by one of the two worm-wheels seen upon it and rotated by the other one; the rate of feed being variable by means of the Sellers friction disks. The two milling heads can be set at the required angle, and as the cut proceeds are gradually separated slightly to give increased thickness of the drill center towards the shank; this being accomplished by means of a small shaft lying below and parallel to the feed-screw, which shaft carries a pinion that engages with rack teeth cut upon a bar that passes transversely behind the heads and is connected by levers that look as though they moved the nuts that are under the heads.

Hans Renold, of Manchester, who has been here during the past few days, tells me he has some of these machines, which he uses in making his own twist drills, and when I asked him why he made them, he said he did it because he could put a grade of steel into them which he could not secure in the manufactured article, and the higher grade steel made the drills so much more durable that it was far better economy to use them. This brings up the old question in regard to the grade of steel to be used in manufactured tools. Of course we all know that when the cost of finishing a tool is large in proportion to the cost of the steel that goes into it, it pays to use a high-grade steel, and if, in addition to this, removing of dull tools for grinding and the setting of sharp ones means that a valuable machine tool stands idle for some minutes, the advantage of using the best steel becomes still greater. Each drill maker must of course do business with some regard to the prices quoted by his competitors, and if he uses a grade of steel which his own judgment tells him is most economical in the long run, he may have to get a price for his drills that will cause him to lose too much trade with the hardware and supply stores where discounts are the chief consideration. He does the natural thing—i. e., he balances one consideration against another and puts in the best steel that he believes he can induce drill buyers generally to pay for. But is it not possible that the time has arrived when there is a demand, or could be a sufficient demand, for drills, taps, dies, milling cutters, reamers, etc., made not merely of "good steel," but of the best steel that can be found to make them

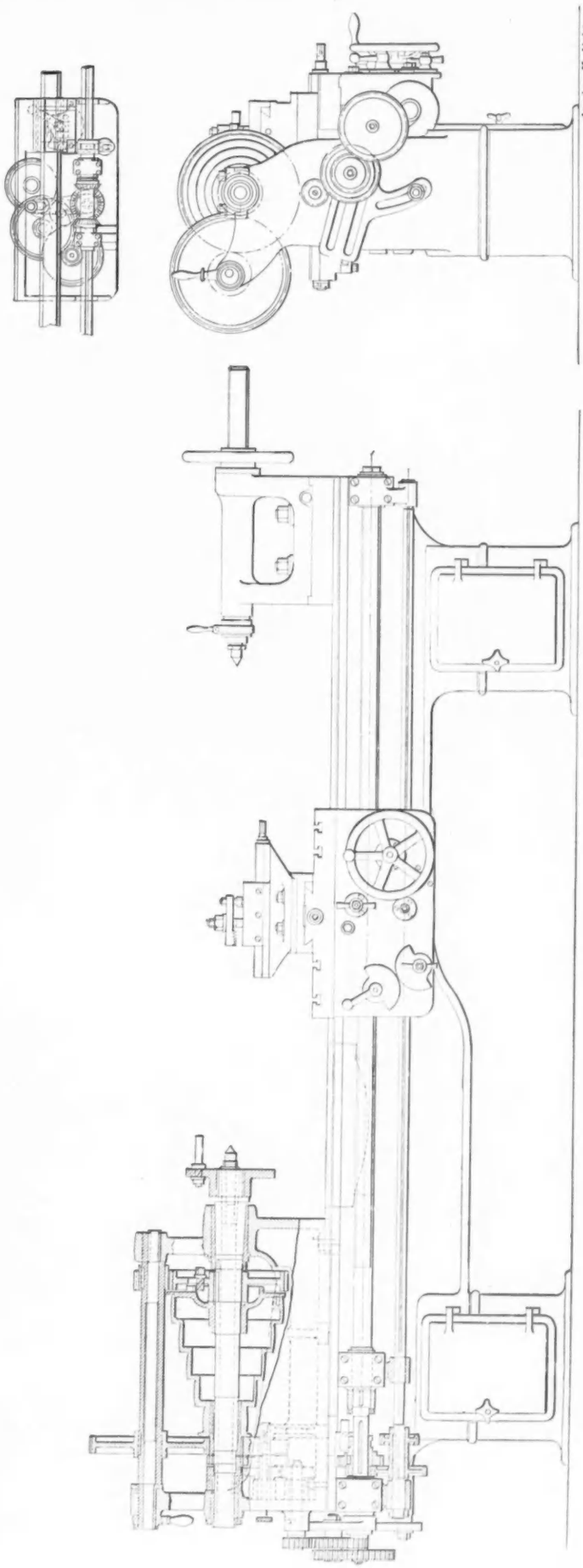


Fig. 20 REINECKER'S 300M/M, OR 23-INCH, LATHE.

of? It seems certain that the mechanical basis for the use of such steel in these tools already exists, and it seems a pity that the purchasing agent and the supply store buyer should stand in the way of its being done.

A 300MM. LATHE.

Figs. 19 and 20 show the latest improved Reinecker lathe as exhibited here, and which is evidently well liked in continental shops. Its chief points of difference from our American lathes are readily seen, the chief one being the inevitable gap. The compound rest is of different form, having an equal overhang or projection each side of the circular base; the tail spindle passes clear through the footstock, and the lead-screw is larger and of coarser pitch than ours. The drawing shows the method of getting two rates of speed for the feed rod from the screw by shifting the sleeve on the screw, which sleeve carries two different sized gears, and there is another change above, as shown, where a short intermediate shaft between the spindle and the stud carries two gears, one of which is driven by a gear on the spindle, the other by a gear on the cone pulley. A shifting key makes either of these gears the driver, and thus there is a change of speed for either feeding or screw cutting, which is in the ratio of the back gears of the lathe, and of course comes in very conveniently for cutting worms or screws of very coarse pitch or for fast feeding. The workmanship shown on these tools is of a high order, and the entire exhibit is a very interesting one.

A certain manager of a new and important industrial establishment here in France concluded that he did not want to put into the shop the usual French windows, that are made in two parts and open in the middle like a double door, but that he would prefer to have the windows slide up and down as they do in America, where he had spent several years, although of European birth. He therefore imported the frames and sash complete from America, and immediately had difficulty with the workmen, who strongly objected to them and said they could not work in a shop that *"fenetres a la Guillotine."* Things which slide up and down like a guillotine knife are apt to be regarded with disfavor, but it had not been foreseen that this objection would be manifested so strongly against windows.

F. J. M.

Paris, May 18.

Works of the Bullock Electric Manufacturing Company.

The plant of which we are here enabled to offer some views and a brief description is of especial interest as representing the most modern development of electric driving. Another interesting feature of this plant is in its illustration of the inadequacy of estimates and expectations in the designing of works for rapidly developing industries. The present works were occupied by the Bullock Company at the beginning of 1899, in the belief that with a capacity treble that of their old shops there would be ample room for a long time to come. Yet it is stated that after the lapse of a year the works are crowded, notwithstanding the running of night and day gangs, and an early extension is imperatively demanded.

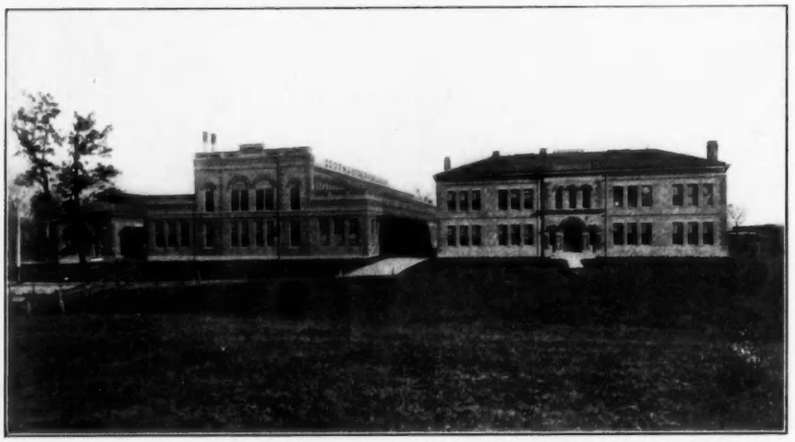


FIG. 1. WEST FRONT OF WORKS—BULLOCK ELECTRIC MANUFACTURING COMPANY.

The site comprises an area of about twelve acres, with a frontage of 750 feet on Forest avenue, East Norwood, a beautiful suburb of Cincinnati. The Pennsylvania and Baltimore & Ohio Southwestern Railways form a junction at this point, and sidings from both roads afford excellent shipping facilities.

Fig. 1 shows the west front of the works. The power-house is at the left, the main machine shop in the center and the administration building to the right. The plan contemplates the erection of another building the same as the center one to the right of the administration building.

The walls of the various buildings are of light brown pressed brick, and the roof of the main building of a steel truss construction with skylights of translucent fabric instead of glass. This material being a non-conductor of heat, little or no condensation forms on the inner side, and in consequence there is no trouble from "sweating." It produces a soft, mellow light which enters every nook and cranny of the place. There are no dark corners or deep shadows to be found.

The power plant consists of two 250 horse-power vertical water tube Cahall boilers, with chain grates made by Aultman & Taylor, of Mansfield, Ohio. A cross compound Lane & Bodley engine is direct connected to two 100-kilowatt multiple-voltage generators. These generators are provided with two commutators each, and supply current at four different voltages, namely, 44, 56, 66 and 84. The generator circuits are carried to the switchboard in vitrified conduits. The switchboard is provided with a recording watt meter and ammeter for each of the four circuits. A 100-kilowatt 125-volt generator direct connected to a 14x14 "Ideal" engine furnishes light and also additional power for testing purposes. A 25 horse-power Nash gas engine direct connected to a 15-kilowatt type "I" generator is used for lighting the administration building when the main plant is shut down. This machine may also be used for driving a few machine tools when the balance of the plant is out of service. From the power-house switchboard the mains run to a distributing board in the testing department. From this point the several circuits of the multiple-voltage system of distribution are led through two conduits located each side of the main aisle underneath the floor and reaching the entire length of the shop. To these mains the necessary connections for each machine are made. The leads to the machines are located in grooves in the floor covered by channel irons, which may readily be removed when it becomes necessary to examine the circuits.

The machine tools are arranged as best suits their requirements, there being no necessity for the lining up with a main shaft as is the case in belt-driven establishments. The system of distribution installed provides for six speeds in either direction without the use of back gears and with constant torque. The controller handles are so located that the operator can reach them without moving from the work, and requires but an instant to change from maximum speed forward to maximum speed backward. The great facility offered for changing the speed and reversing the direction of rotation is one of the most advantageous features of the electric drive, as the operator can readily secure the best speed at which to operate on any given piece of work. A 20-ton electric traveling crane runs the full length of the main aisle and facilitates loading and unloading material from the steam railroad cars, which are brought within the works upon sidings from the Baltimore & Ohio, Southwestern and Pennsyl-

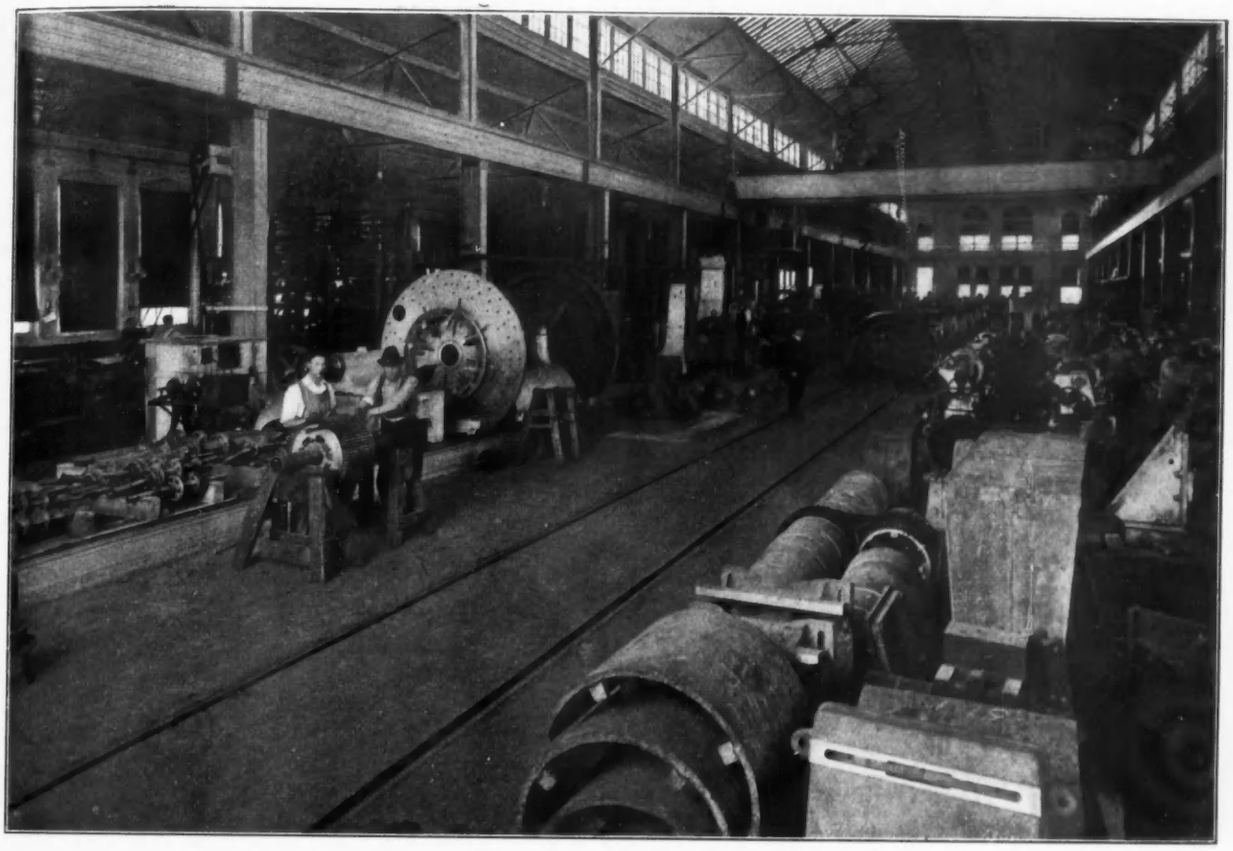


FIG. 2. MAIN AISLE, LOOKING WEST.

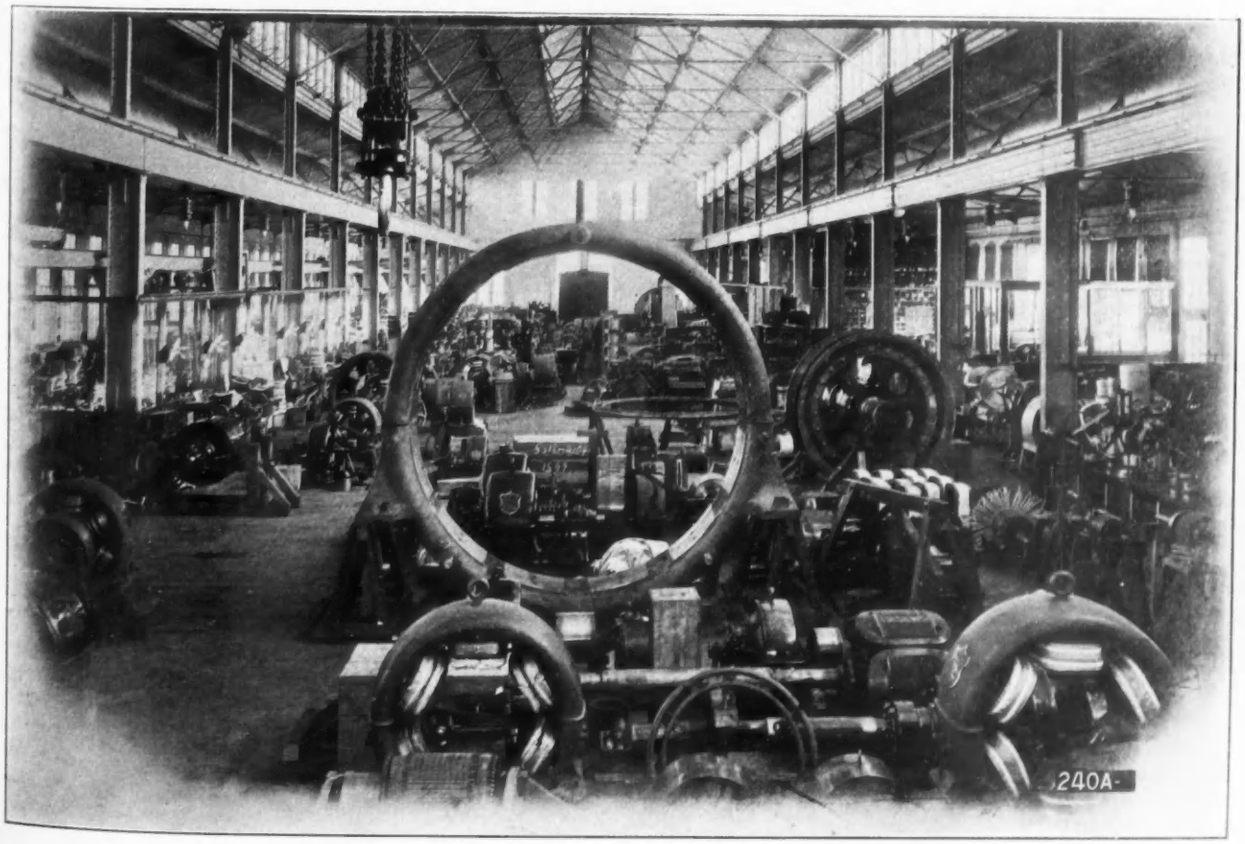


FIG. 3. MAIN AISLE, LOOKING EAST.

FIG. 4. THE TOOL DEPARTMENT.

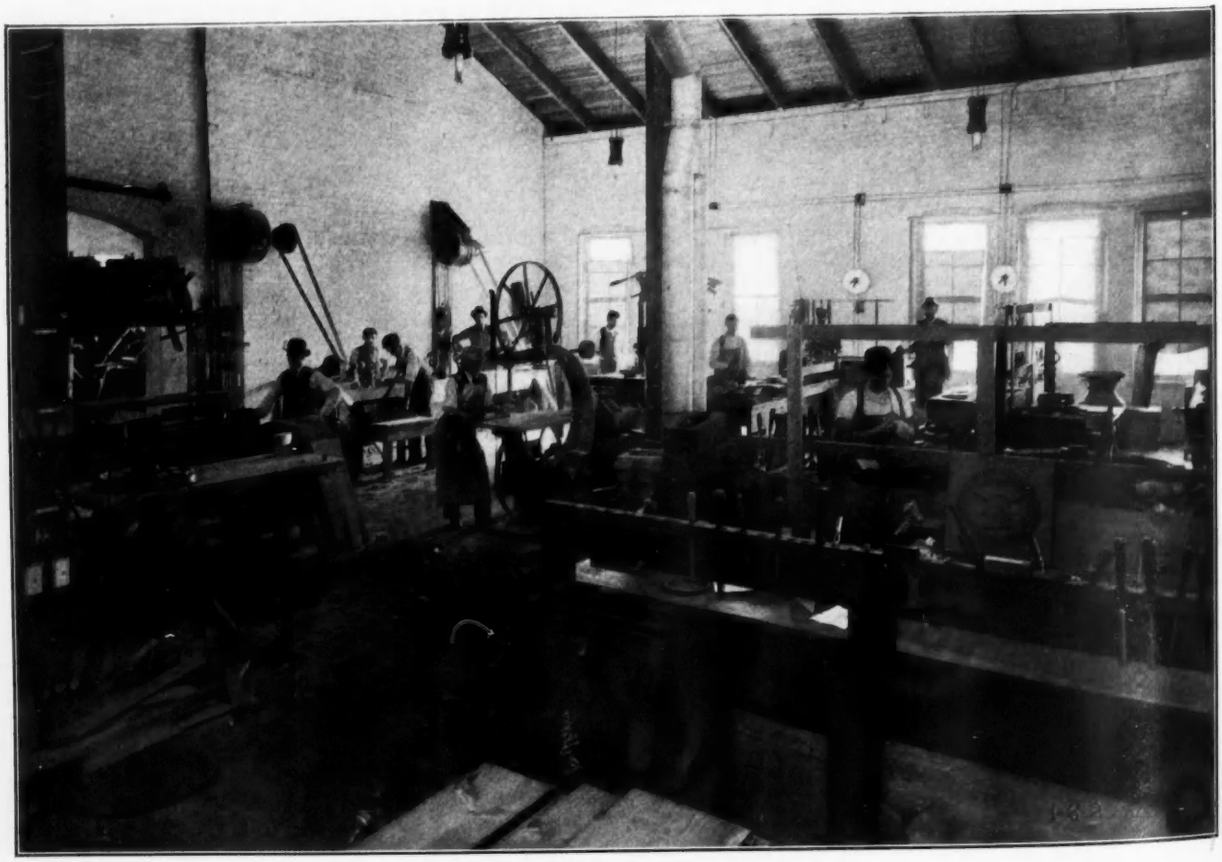


FIG. 5. THE PATTERN SHOP.

vania systems. It also provides a ready means of lifting the work into and from the machine tools. Several hand traveling cranes are provided for the side aisles, greatly facilitating the handling of work within those areas.

A Buffalo Forge Co.'s steam driven fan, 110 inches in diameter, is located in a chamber underneath the room set apart for the men's reading and lunch room. During the winter this fan draws cold air over the steam heated coils, heating it up to about 180 degrees, and it is then forced through a 6x6-feet header running across the west end of the machine shop; 48-inch risers connect to the overhead distributing mains, which are provided with dampered outlets every few feet. These mains gradually taper down to about 30 inches at the east end of the building. In summer time the temperature of the warm air is materially reduced by drawing it over the same set of coils filled with cold water. Thus the temperature throughout the works is maintained at a point which is very comfortable in summer and winter.

Every machine tool throughout the works has its individual motor, and in most instances the motor is direct connected to the machine, belts being omitted wherever possible. Some excellent examples of electrically driven tools are here found. The absence of belts is very striking, and impresses one with the idea that he is looking upon machines that are upon exhibition rather than those in practical service, and it is this feature, permitting, as it does the free use of the overhead traveling crane, which saves a tremendous amount, of time in handling the work. As above stated, the distribution of the power is by the multiple voltage system which provides for six speeds forward and six backward at constant torque, the power consumed being proportional to the speed of the motor. No resistance is used in the circuit, and the energy usually dissipated in heat when motors are controlled by the rheostatic method is saved.

In the construction of this plant the Bullock Electric Manufacturing Company has sought to provide as many conveniences as possible for its employees. Among those that are now operative may be mentioned a lunch and reading room, individual lockers, shower baths and wash basins with running water. In the reading room complete files of about forty periodicals are available. This feature is much enjoyed by the majority of the employees who are seeking to keep posted on the developments of general as well as special interest. It also aids those who are seeking to advance themselves by studying the problems that are treated in the trade press. Many of the employees are students in the correspondence schools, and to these the mechanical papers are of special interest.

The various views presented will be understood without explanation. The absence of shafting, as previously spoken of, will be noticed throughout, giving a light and roomy appearance not seen in the old-time shops. Fig. 2 shows the interior of the main building, looking west, or toward the front, and Fig. 3 is in the same building, looking in the opposite direction. Fig. 4 shows the tool department at one side of the building. Figs. 5, 6 and 7 show respectively the pattern shop, the brass foundry and the drafting room.

FIG. 6. THE BRASS FOUNDRY.

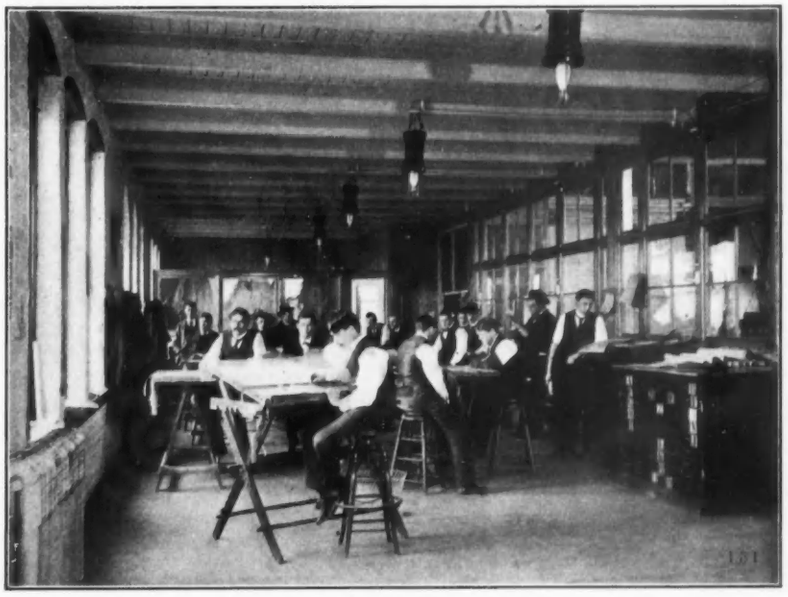


FIG. 7. THE DRAFTING ROOM.

Near Camden, N. J., nearly a ton of the heavy feed wire of a trolley line was stolen a few nights ago. This is a simpler job than it would be to cut and carry off a steam pipe.

Analysis of the Cams of the Geometric Boring Tool.

BY J. B. TAYLOR.

In the article on a "Geometric Boring Tool," in the "American Machinist," No. 18, we have an interesting application of the use of higher pairs. In Reuleaux's "Kinematics" the subject of cams to work in complete constrainment as elements of higher pairs is examined with a great deal of ingenuity, and a number of forms are given. The analysis of the cams shown in your article is not difficult when treated by the method of instantaneous or virtual rotations, and requires only a draftsman's tools and a few principles. It may be well to briefly state

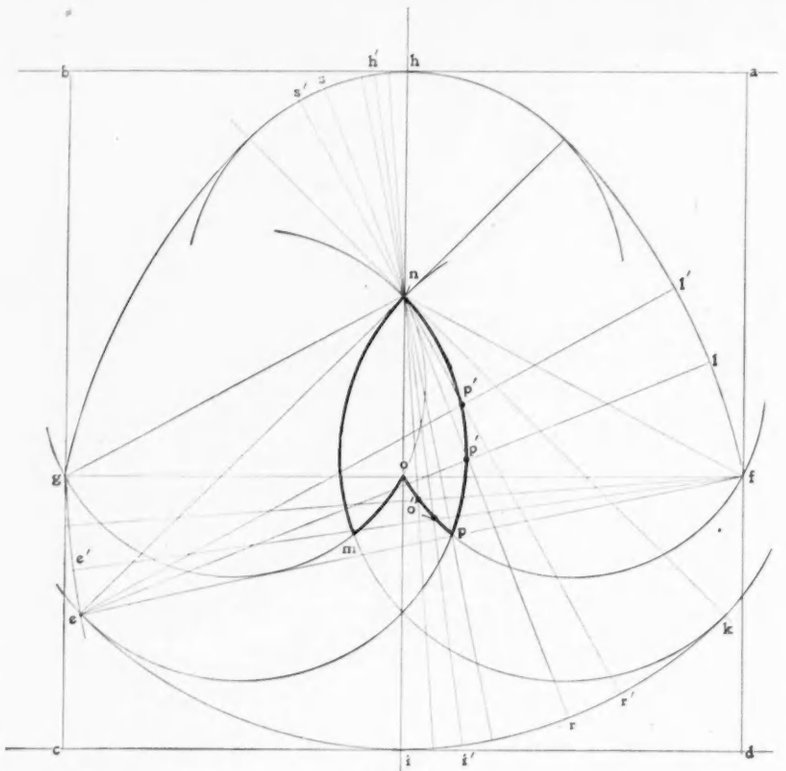


Fig. 1

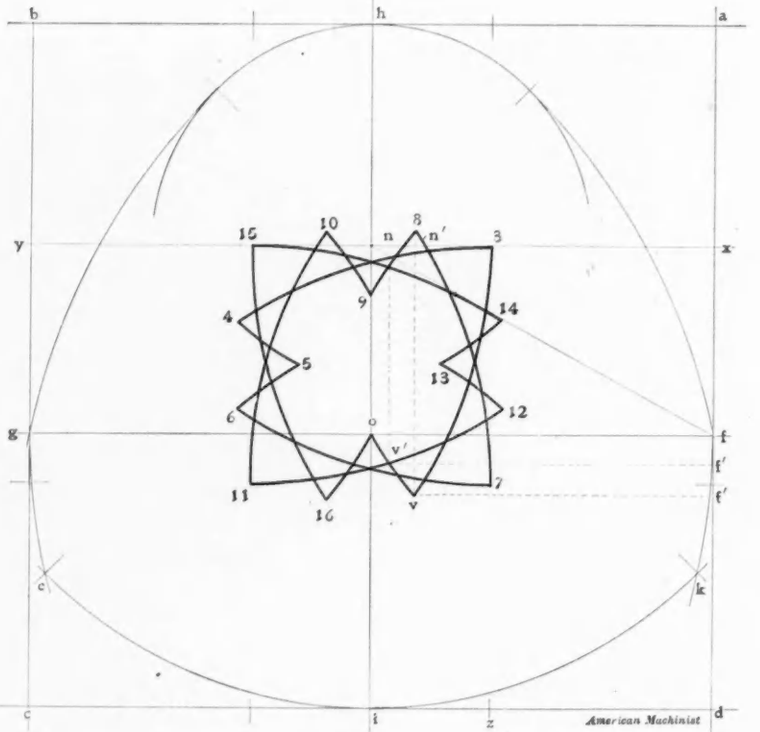


Fig. 2

DETERMINATION OF CENTRODES OF CAMS.

these principles, for while they are no doubt familiar to many of your readers, there may be some who have not had their attention called to their use.

The cams are to be constrained in every position—that is, they are to work without shake. In order to obtain this result, the inner cam must be a figure of constant breadth, so that for any position the normals at the points of contact must be equal to the side of the circumscribed square. An examination of the inner cam, whose outlines consist of circular arcs, shows that it fulfills these conditions. Since the cams cannot have a motion of sliding (sliding here refers to motion of the cams as a whole), the only motion they may have relatively is rotation. In Fig. 1, suppose the outer cam fixed and the inner in motion, or *vice versa*. At this instant the points of contact are *h, f, i, g,* and these points for the instant are moving respectively in the directions of the sides of the enclosing square *a b c d,* which are the direction tangents. These points are therefore rotating for the instant about some point in the normals *h o, f o,* etc. The points *h, f, i, g* are all points of the moving cam, and rotating with it about the intersection of these normals. This intersection is a single point *o,* and the normals form four right angles. This follows from what has been stated above, and if they did not so intersect, the cams would not be constrained. This point *o* is the virtual or instantaneous center, and it is the point about which the cam is for the instant rotating. Generally for any other position of the cam a different instantaneous center will be found. Now if the inner cam be fixed and the outer cam rotated, and the instantaneous centers be marked for the successive positions, a curve is traced which is called the centrode. Then let the outer cam be fixed and the inner rotated, and the locus of the instantaneous centers will give a second centrode. If these two centrodes be rolled one upon the other, they will reproduce exactly the relative motion of the cams. The successive intersections of the normals are the points of contact of the centrodes as they roll upon each other. We now have all that is necessary, and may proceed at once to find the centrodes.

In Fig. 1 let the inner cam be fixed, and the outer have left-handed rotation. The intersection of the normals at *o* gives a point of the centrode at once. Let the point of contact *h* move along to *h'* which gives the points *o', p,* etc., by intersections of *h' i'* with *f e', f e,* etc., and a portion *o p* of the centrode is obtained. Continuing the motion, the intersections *s r, s' r'* with *e l, e l'* give the points *p' p',* and by taking a sufficient number *p n* is found. A complete rotation of the outer cam—in this case less—gives the centrode, which is found to be *o p n m o.* We have now to see if the centrode may be identified with any known form of curve. Upon examining Fig. 1 it will be seen that *n o f, n o' f, n p f* are right angles, and with the line *n f* form right-angled triangles in which the hypothenuse *n f* is constant. All these points therefore lie upon the circumference of a circle whose diameter is *n f,* and the centrode *o p* is an arc of this circle. In a similar manner from *n p' e, n p e,* it is evident that *n p* is an arc of the circle described upon *n e* as a diameter, and *n m* and *m o* are arcs of circles

of diameters $n\,g$ and $n\,k$. The centrode is composed entirely of circular arcs. To find the second centrode, let the inner cam, Fig. 2, rotate, the other being fixed. The point o is at once determined. As the cam rotates, the vertical normal passes through n, and the horizontal normal through f. Consider $n\,f$, which is a fixed line of the cam; the point n of this line is moving along the line $n\,x$ ($n\,h$ constant), and the point f along $a\,d$. The intersections at v' v, etc., give the rectangles $n'\,v'\,f'\,x$, $n'\,v\,f'\,x$, etc., in which the diagonal $n\,f$ is constant. Therefore points v, v', o, etc., lie upon the circumference of a circle whose center is at x; $n\,f$ equals $x\,o$. In a similar manner $v\,3$ is found to be a circular arc with center at y; 34 a circular arc with center at z, and continuing the rotation the completed centrode o, v 3, 4.... 16, o is obtained, and, like the first centrode, is found to consist entirely of circular arcs. We at once infer that as the motion is produced by rolling one circular arc upon another, that some form of cycloidal curve will result. Next let an effort be made to determine the ratio of the circles which form the centrodes.

In Fig. 3, circle A formed $o\,p$ of Fig. 1, and circle B formed $o\,v$ of Fig. 2. Now, $n\,f$ is equal to $o\,x$, therefore the ratio of diameters is 1 : 2. Similarly, C and D have the same ratio. Now, it is well known that if two circles have the diameter ratio 2 : 1, and the smaller be rolled internally upon the larger, any point on the circumference of the smaller describes a straight line. n is such a point for both circles, and as each pair alternately take up the motion, the point n traces out the square whose corners are 3, 7, 11, 15 of Fig. 2. What was a very complex case of motion is by the aid of the centrodes made quite simple.

The point n is but a particular point, and by selecting others—which is equivalent to having the tool point adjustable—an infinite number of roulettes of cycloidal or trochoidal form may be generated. All of these could not be bored, as some of them would be looped and in others the corners would terminate in cusps. Some very fair approximations to the square can be obtained, thus increasing the range of the cams, but, to be perfect, would have to be finished at the vise or by broaching.

When the outer cam is rotated it is equivalent to rolling the larger circles on the smaller, and another set of roulettes of cardiod form are generated. By making a tracing of the cam and centrode of Fig. 1 and rolling it upon the centrode of Fig. 2, the different motions can be readily seen, and by marking of point paths the numerous curves can be examined, some of which will be found to be very curious and worth examination.

A better cam for practical use than the one here examined and which will also trace a square, can be made by properly replacing the sharp corners k and e with small circular arcs and omitting the circular arcs $f\,k$ and $g\,e$. I have not examined the cams for tracing the hexagon, but they may be treated as above, and from the straight lines it might be inferred that the centrodes are composed of circles having the same ratio as those which have been found for the first cams.

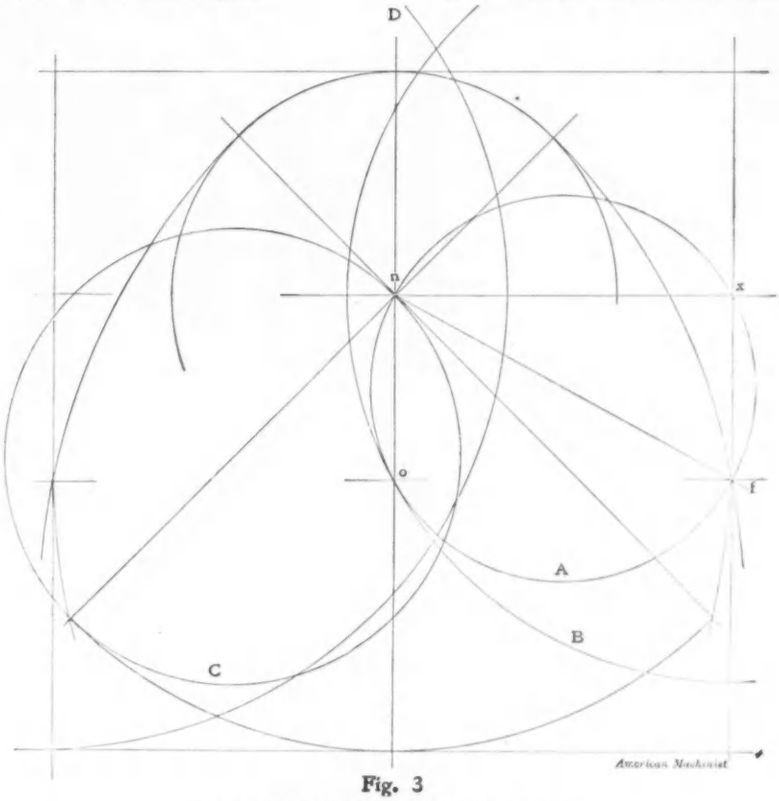
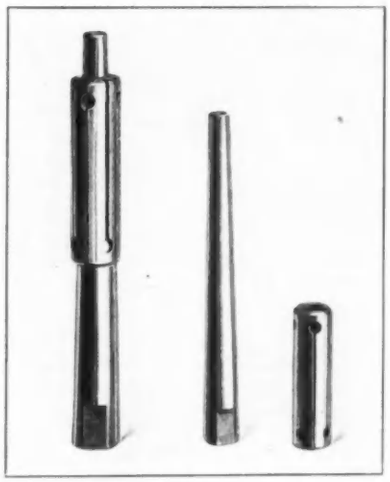


Fig. 3

THE RELATIONS OF THE CIRCULAR ARCS.

An Expanding Mandrel.

The half-tone shows an expanding mandrel which will be readily understood. At the left is the complete mandrel, and the two parts which compose it are at the right of it. There is a taper mandrel with good centers, hardened and accurately ground, and upon this is a sleeve with a taper hole fitting the mandrel and with the outside of the diameter required. The sleeve is alternately slitted from each end, enough being left at the end of each slit to hold the sleeve together. As will readily be seen, driving in the mandrel expands the sleeve. These mandrels are made in twelve numbered sizes, for diameters from ½ to 6½ inches. Nos. 1 to 5 have one sleeve, and the others have two sleeves each. No. 1 takes ½ to 9-16 inch, and No. 12 takes 5 to 6½ inches. The mandrels are made by the Western Manufacturing Company, Springfield, Ohio.

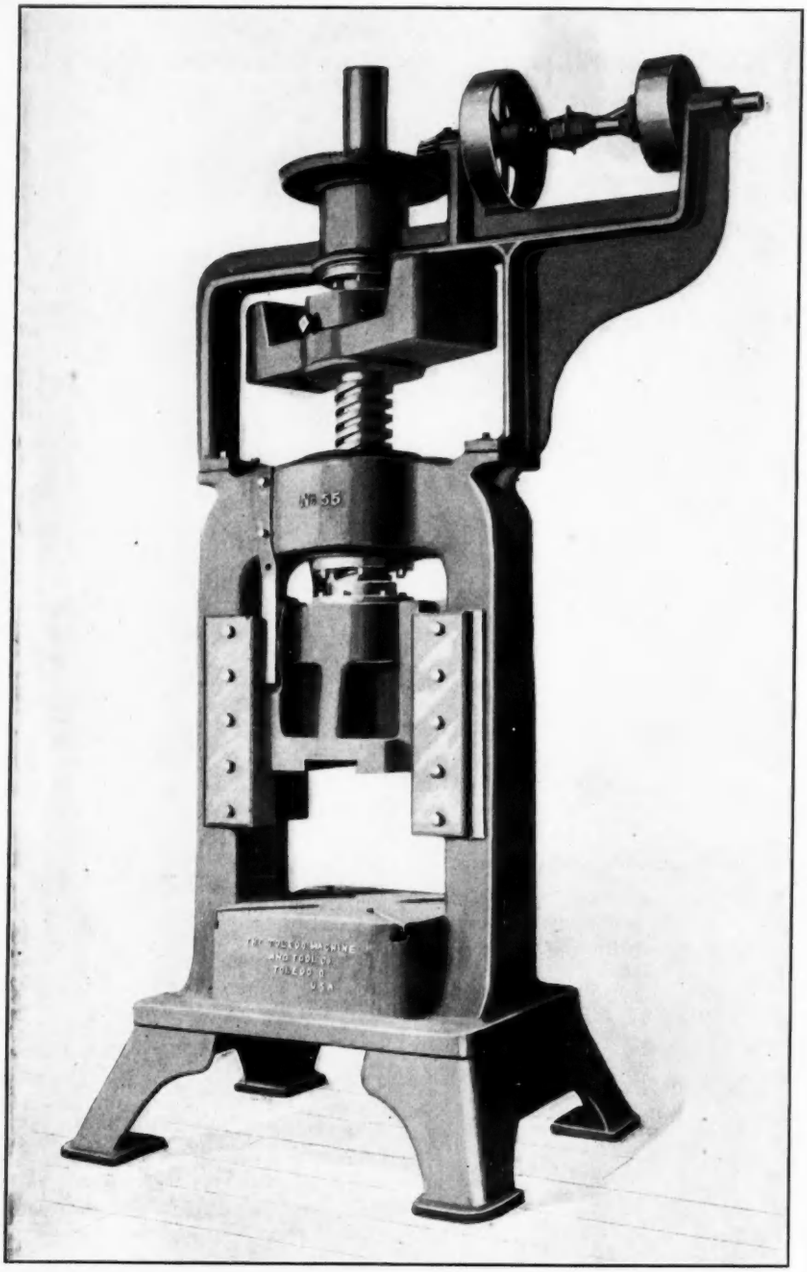


AN EXPANDING MANDREL.

It would seem to be almost easier to make steel than to define it. The following is the way it is done in the United States tariff laws: "All metal produced from iron or its ores, which is cast and malleable, of whatever description or form, without regard to the percentage of carbon contained therein, whether produced by cementation, or converted, cast, or made from iron or its ores by the crucible, Bessemer, Clapp-Griffiths, pneumatic, Thomas-Gilchrist, basic, Siemens-Martin, or open-hearth process, or by the equivalent of either, or by a combination of two or more of the processes, or their equivalents, or by any fusion or other process which produces from iron or its ores a metal either granular or fibrous in structure, which is cast or malleable, excepting what is known as malleable-iron castings, shall be classed and denominated as steel."

A Power Screw Press.

The half-tone shows a screw press that is made principally for the manufacture of shovels and goods of that character. As will be seen, it is a very simple machine, requiring little explanation. The frame consists of a single casting, it thus being more rigid and occupying less space than if built up of three or four pieces. The screw, which is double threaded, is of high-carbon, open-hearth steel, and the nut is of phosphor bronze and of unusual length. The gearing is entirely of steel, and the ram or head is provided with anti-friction bearings for the end thrust of the screw. The machine is operated by a new style of friction clutch, arranged to stand the severest service. The inner or larger pulley is used for the downward or working stroke of the ram, and the outer and smaller pulley gives a quicker speed for raising the ram. The friction clutches for these pulleys are operated by a hand lever, not seen. This press is built by the Toledo Machine and Tool Company, Toledo, Ohio.



A POWER SCREW PRESS.

Crane Hooks.

BY C. F. BLAKE.

Several empirical formulas for crane hooks have been published by different authors, giving the proportions in terms of the neck of the hook, the diameter of the rope used, the weight of the load sustained, or some other easily determined factor. While these formulas are given in Towne, Unwin and others, it is disappointing to find them followed by the announcement that they are correct only "for hooks up to a capacity of 10 tons," or that they are *"less* likely to lead to error in extreme cases" than others. In the later editions of Unwin the expressions for the fiber strain f are given for the section $m—n$ in Fig. 1, which he, as well as Reuleaux, Weisbach and others, treats as a section eccentrically loaded. The formulas given in the table agree with these authorities. They have been used for hooks up to 50 tons capacity, and are suitable for any load.

In the notation of the table:

P = Load to be sustained by the hook,

S = Area of section $m—n$ in square inches,

R = Radius of gyration of the section.

f = Safe fiber strain in pounds per square inch for material used.

The remaining letters refer to the dimensions as shown in the table.

Having determined upon the load to be carried P, and the allowable fiber strain f, the diameter of the neck $= a$, and the area of the neck $= .785\,a^2$, then

$$P = .785\,a^2 f,$$

or,

$$a = \sqrt{\frac{P}{.785\,f}}$$

which is formula 1 in the table.

The four most usual sections are those shown in the table. Having determined upon the section to be used, proceed as follows: Give a value to r suitable for the diameter and number of ropes or chains which it is probable will be coiled into the hook, or suitable to the bail of dipper or other contrivance which the hook is designed to carry. Also assume convenient values for all the dimensions, but one, b, c and d of the section chosen. Now substitute these assumed values in equations, 1, 2, 3 and 4, opposite the chosen section and solve each equation, obtaining values of y_1, y_0, R^2 and S in terms of the undetermined dimension. Substitute these values in general formula 3. Also substitute for P and f their previously determined values. It will then be seen that the only unknown quantity in the equation will be the undetermined dimension of the section, whose value will be found by solving the equation. General formulas 2 and 4 are other forms of formula 3, and become useful in case the section is known, and the load the hook is capable of holding is to be determined.

The final solution of the general formula will be found to involve quadratics, but this may be easily avoided in practice by assuming *all* the three dimensions b, c and d and solving the formula to find the resulting value of f. After thus substituting numerical values for b, c and d in the equations, there is left only a problem in simple arithmetic, with f as the unknown quantity upon one side of the equation. Should f prove to be too large or too small upon the first trial, a second attempt, having altered the dimensions ac-

cordingly, will be all that is necessary to obtain a properly proportioned hook. Having determined the dimensions of the section *m—n*, the rest of the hook must be proportioned to suit the designer's idea of symmetry, taking care that the section *k—l* is strong enough to hold the load in shear. The diagram in the table shows a good method of placing centers and radii. Many designers prefer to place the section *m—n* at an inclination downwards from the horizontal; but this should not be carried too far, about 10 degrees being all that is well.

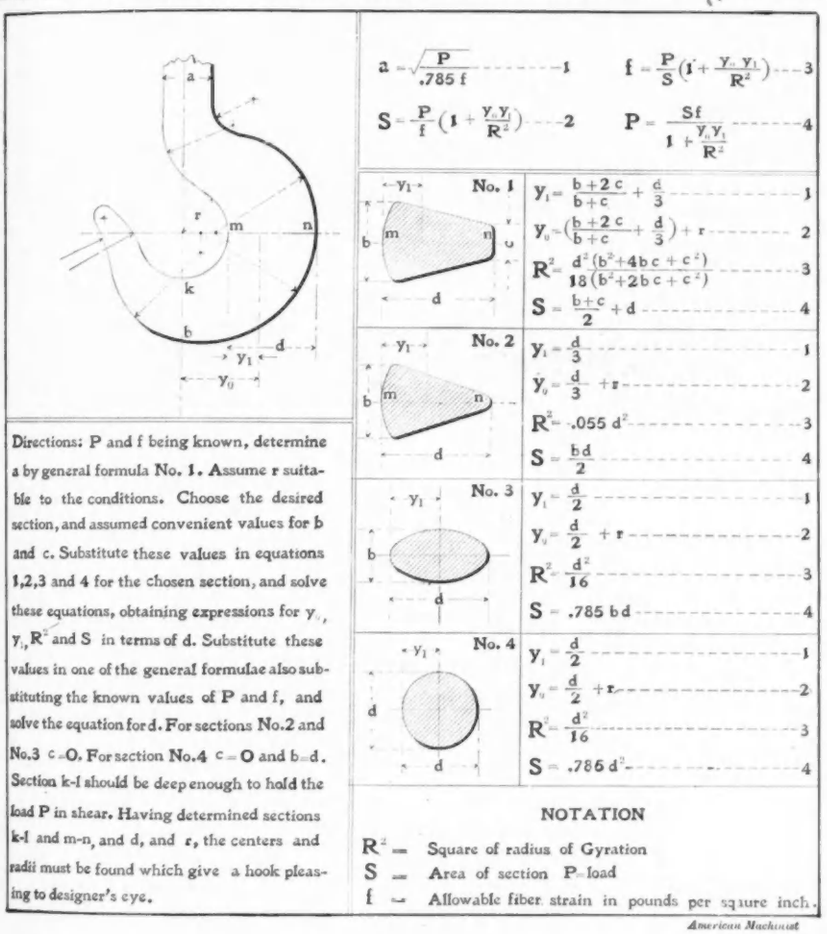

a = √(P / .785 f) ---- 1
S = P/f (1 + y₀y₁/R²) ---- 2
f = P/S (1 + y₀y₁/R²) ---- 3
P = Sf / (1 + y₀y₁/R²) ---- 4
No. 1
y₁ = (b+2c)/(b+c) + d/3 ---- 1
y₀ = ((b+2c)/(b+c) + d/3) + r ---- 2
R² = d²(b²+4bc+c²) / 18(b²+2bc+c²) ---- 3
S = (b+c)/2 + d ---- 4
No. 2
y₁ = d/3 ---- 1
y₀ = d/3 + r ---- 2
R² = .055 d² ---- 3
S = bd/2 ---- 4
No. 3
y₁ = d/2 ---- 1
y₀ = d/2 + r ---- 2
R² = d²/16 ---- 3
S = .785 bd ---- 4
No. 4
y₁ = d/2 ---- 1
y₀ = d/2 + r ---- 2
R² = d²/16 ---- 3
S = .785 d² ---- 4
Directions: P and f being known, determine a by general formula No. 1. Assume r suitable to the conditions. Choose the desired section, and assumed convenient values for b and c. Substitute these values in equations 1,2,3 and 4 for the chosen section, and solve these equations, obtaining expressions for y₁, y₀, R² and S in terms of d. Substitute these values in one of the general formulae also substituting the known values of P and f, and solve the equation for d. For sections No.2 and No.3 c=0. For section No.4 c=0 and b=d. Section k-l should be deep enough to hold the load P in shear. Having determined sections k-l and m-n, and d, and r, the centers and radii must be found which give a hook pleasing to designer's eye.
NOTATION
R² = Square of radius of Gyration
S = Area of section P=load
f = Allowable fiber strain in pounds per square inch.
American Machinist

Fig. 1

THE DESIGN OF CRANE HOOKS.

Example—A 7½-ton hook is to be made of triangular section No. 2, of the following dimensions: $P = 15{,}000$ pounds, $b = 3$ inches, $d = 5$ inches, $r = 2$ inches. What will the hook be strained to?

$y_1 = \frac{5}{3} = 1.66$. $y_0 = 1.66 + 2 = 3.66$.

$R^2 = .055 \times 25 = 1.375$. $S = \frac{3 \times 5}{2} = 7.5$.

Using general formula No. 3,

$$f = \frac{15{,}000}{7.5}\left(1 + \frac{3.66 \times 1.66}{1.375}\right)$$

$f = 9{,}200$ pounds per square inch.

The allowable fiber strain f must be left to the judgment of the designer and his knowledge of the material of which the hook is to be made. Hooks are very liable to be subjected to sudden shocks, and the strain should be kept down to what is safe for these conditions. About 7,000 to 8,000 pounds per square inch for cast steel and 10,000 to 12,000 pounds for mild steel forgings will be good practice.

The method here given is applicable to any short piece of mechanism eccentrically loaded, whether in tension or compression. Take, for example, the short, bent eye-bolt shown in Fig. 2. The proper diameter for the bolt will be determined by the formulas for section No. 4 in the table. If under tension with a load P_t, the fiber strain f_t must be chosen for the material under tension; while if loaded under compression with a load P_c, the fiber strain f_c must be chosen for the material under compression. This is only applicable to *short* pieces, however, and *not* to long tension rods and struts.

The Japanese Navy consists of ten first-class battleships, ten first-class armored cruisers and twenty fast protected cruisers, together with torpedo boat destroyers, gunboats, etc., which bring the total up to ninety vessels of all classes. This navy has been built since 1880. It is of the latest design and build, and is fitted with armament of the most modern character. One of the most recent additions is the "Asahi," of which the offensive and defensive qualities are unexcelled.

Letters from Practical Men

The John Cookson Gun.

Editor American Machinist:

I am sixty years old, and for fifty-five years have been familiar with a great many forms of firearms, from the time when I used to fire a flint-lock laid in a chair until now, when there are certainly twenty-five shotguns and rifles, in various stages of rust and disrepair, collected by myself and four boys, in my house.

Up to the year 1855 flint-lock rifles and shotguns were very common for sporting and hunting, and a good deal of work was being done "percussioning" the old guns; that is, fitting them with the cone and hammer for the percussion copper caps,

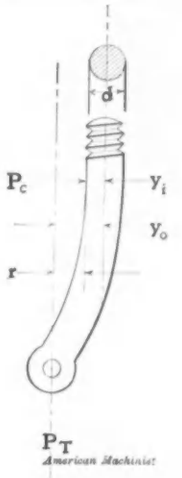


Fig. 2

APPLICATION OF FORMULA TO A SHORT BENT EYE-BOLT.

all of which were patented in England by John Day in 1823.

The fulminate—from *fulmen*, thunder—of mercury was tried, as shown by the patent records of England, for some years before John Day, in various crude forms, such as prepared tapes and pellets of various kinds.

The fulminates of mercury and of gold were described by Robert Boyle about 1670, and the method of preparation is much the same to-day as it was then.

The figures 1586 on a gun made in England, if intended to show the year in which it was made, are certainly seventy years too previous. The printed history of firearms in the abridged patents of England says that flint-locks were introduced in the time of Charles II. Robert Boyle, founder of "The Royal Society for the Improvement of Natural Knowledge," under Charles II, recorded a great many experiments in the year 1656 made with a flint-lock pistol, which he calls "a new invented snaphaunze imported from the Netherlands"—Holland.

I am the proud owner of three little volumes of an abbreviation of Boyle's works, printed in 1700, and it is to me a continual

wonder that no one in this age seems to know anything about him. Here is "electricity in the air" a century before Franklin; "heat as a mode of motion," illustrated by the heating of dull tools in turning iron and brass guns, two centuries before Tyndall; the proper colors for drawing the temper for different tools in hardened steel; there is also every possible experiment in pneumatics, and pretty good chemistry. The above is something of a digression, but after writing Boyle's name I cannot avoid a eulogy.

The whole story about the burial of that gun in a junk shop and its miraculous resurrection, with the date of making, 1586, so plainly stamped that there is no mistake, is a very good way of getting dollars from rich buyers, and it has the old familiar style of the stories of the "Old Masters' " paintings buried for centuries in dirt and smoke, and resurrected for credulous buyers. The business in "antiques" is very good in Connecticut. The fashion to-day is for relics of imaginary ancestors, and stinking brass fire utensils, door knobs and knockers best fill the aching void. A man in New Hampshire makes flax spinning wheels for the same purpose which are not stinkable.

WILLIAM H. HARRISON.

A Corner Rounding Tool for Pattern Makers and Woodworkers.

Editor American Machinist:

Knowing the value of a handy tool, and being desirous of giving my fellow craftsmen a tool that will quickly pay for itself, I send you a "corner rounding" chisel. I have never seen anything like it, but, having used it for a considerable time, it may be old to some of the wide-awake pattern-makers; but it certainly was new to me when I had it made and tried it. This tool performs the functions of a chisel, spokeshave or plane, with one-tenth of the labor of either of the above named tools. Nearly all patterns have many corners to be rounded. The usual way is with a flat chisel, a spokeshave or a small plane, and after the corners have been rounded in this manner they are either of an uneven surface or they are not smooth until considerable sandpapering has been performed. By the use of this tool the corner can be rounded in such a manner as to dispense with the tedious job of sandpapering, and the time of doing the work is considerably reduced. With but one stroke of the tool the sharp corner of a pattern or piece of wood is reduced to almost a perfect circle without any sharp edges to be sandpapered. This tool can be made in two or three sizes, and these will round almost any sharp corner. Should this be of interest and value to any fellow craftsman he is welcome to it, and I know that if it is once tried it will be one of the most valuable additions to the pattern-maker's chest. T. C. K.

Truing Spring Chucks.

Editor American Machinist:

In regard to the criticism of A. A. H. in the "American Machinist," No. 18, on my method of truing chucks, I wish to say a few words. The emery did not work back to the collar that guided the back end of the lap, and I had no trouble from that source. Neither did the chucks open in hardening, the steel from which they were made having been annealed by the steel maker. Nor did it take an iron grip to close the jaws on to the lap, my physical strength being somewhat under that of the average machinist. And right here is where I thought that the method I used had some merits peculiar to itself. By lapping with little or no pressure applied to the jaws from the outside, the jaws are left in a practically relaxed condition when they bear on a piece of wire of their nominal size, which I think is an ideal condition with this kind of chuck. Also, by doctoring the outside of the jaws, as I described, a large bearing surface is obtained, which will have a tendency to keep the chuck true after it is once made so.

At first I intended to use the lap in the tailstock spindle, as suggested by A. A. H., but as my lathe had been in constant use for about twelve years, I thought the tail spindle might be lower than that in the headstock, and so might make the holes more bell-mouthed than by the method I used. A. A. H. may say that I should have scraped off the bottom of my headstock and scraped my bed true, etc., before making my chucks. This I probably shall do in the near future, but could not do so at the time I made the chucks, and I do not believe in incorporating any old errors into new work if there is any way to avoid it.

As A. A. H. has not seen my chucks, I think it is hardly fair in him to characterize my results as uncertain.

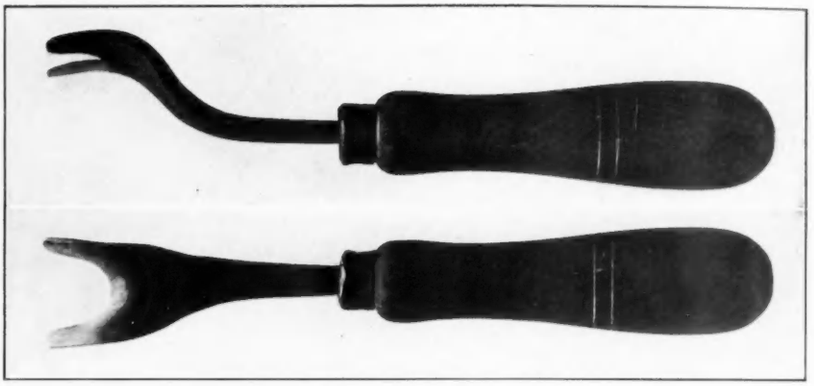
WALTER GRIBBEN.

[We take pleasure in testifying that Mr. Gribben has as little to do with producing "uncertain" results as any mechanic within the circle of our acquaintance.—Ed.]

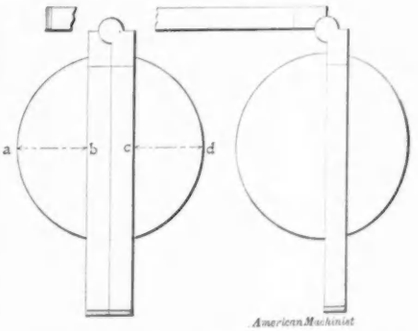
Finding Opposite Points on a Shaft—Drawing a Center Line on a Disk—Prick-Punching after Drilling—Boring-off a Lathe Spindle, Etc.

Editor American Machinist:

Sometimes in marking out work in the shop it is required to find two exactly opposite points on a turned shaft or disk, as, for instance, in marking a key hole, or quartering the cranks of a double engine. This can be quickly done by using a strip of thin tough paper, cutting the ends to meet exactly around the circle, and then folding the paper exactly in the middle for the half circle, and one of the halves may be similarly folded for the quarter circle. An easy way to get a center line across a disk, as in marking bolt holes on a flange, is to lay a common 2-foot rule across and center it by the eye or another rule (see sketch), making $a\ b = c\ d$; then move one-half away and mark by the other half. One of the hard jobs for a boy is to drill exactly to the line, and I have known boys, when they have missed the line badly, to center-punch a line evenly around the hole after drilling. This scheme is not good, but the job looks better—until it is found out. Most all machinists have heard more or less about the fellow who bored off the end of the lathe spindle, but it always happened in some other shop, and the story is generally regarded as a mythical one anyway;



A PATTERN MAKER'S CORNER ROUNDING TOOL.



MAKING A CENTER LINE ON A ROUND DISK.

but I can locate the very job and the man. Our company employed a young man who was addicted to late hours, and while drilling with a flat lathe drill he fell asleep and fed the drill on until the chuck fell off. This is an actual fact. Speaking of lathe spindles brings to mind one of our lathes on which the cubs usually work. They had gouged the center hole badly, so that the center had lost some of its bearing. We repaired it by fitting in a hardened steel ring and grinding it true by a rigid lap held in the tool post. We then made a new center to fit. Drill press tables ought to be bushed in the same way; or, what is better, with a box made in halves and attached to the edge of the table. This would serve to take up the wear of the boring bar and hold it much steadier, and would be frequently more convenient for such work than the center hole.

C. W. CRAWFORD.

The Universal Joint at the Top of the Air Hoist.

Editor American Machinist:

I appreciate the liberty accorded to correspondents who wish to ask questions or to make remarks about what they see or read in the "American Machinist." I have been waiting expectantly for some one of your critics to say something about the "Sentinel" air hoist shown in your issue No. 18. As no one else will say it for me, I must say it myself.

I have no doubt that the hoist as described is all right in its place. The curious thing that I notice about it is that spherical bearing arrangement for the eye by which the hoist is suspended. What in the world is the use of it? The pull between the eye above and the hook below must always be in a straight line anyway, no matter to what angle the whole hoist may be swung. In putting up the hoist it must be an inconvenience and an annoyance to have the eye flopping around loose instead of standing rigid and central to catch the hook. I can't see how the arrangement can be of the least assistance in any case, unless it assists a glib salesman to talk it into an unmechanical customer.

There is one little slip in your description of the hoist, where it is stated that "both the weight and the air pressure assist to keep the spherical joint tight." There is no air pressure there, and it is not necessary to keep the joint tight except for cushioning in case of a sudden upward run of the piston.

St. Louis, Mo. CYRUS T. BROWN.

Drawing a Conical Disk.

Editor American Machinist:

The die which I am about to describe was to blank and draw a conical disk 13-16 inch deep by 4 inches in diameter, with a dead sharp point at the top. The metal to be drawn was sheet brass .022 inch thick. The sketch shows the die and punch complete. *E* is the blanking die, which was a forging composed of a machine steel base with a tool steel ring welded on for the die. It was first planed on the bottom, then strapped to the faceplate of the lathe and bored to admit the forming die *B*. It was also recessed at *L* to keep the forming die central. It was turned and finished on the outside, and then bored to .010 inch less than the diameter of the blank (which is easily found in a straight draw of this kind), tapering inwardly about .1 degree at *F*. It was then taken out of the lathe and made shearing on the top about one thickness of metal by filing it low at two opposite sides. It was then ready to harden, which was done by heating to a cherry red and dipping into a tank of water with about 2 inches of oil on top. It was then polished and drawn to a light straw color, and after that it was set true on the faceplate and ground to the correct size.

The next job was the forming die *B*, which was turned and finished all over, and a hole tapped in the center to admit the stud *H*. The blank holder *C* was a tool-steel ring turned to fit the blanking die freely and bored to fit the forming die without sticking. *G* was a stub wire pin, of which there were six of the same length, and long enough to raise the blank holder level with the top of the cutting die, as shown. There were six equally spaced holes drilled (slightly larger than the pins) in the bottom of the blanking die, to allow the pins to pass through freely. *D* was a cast-iron plate, faced on one side for the bottom of the pins *G*, and bored to fit the stud *H* loosely; *I* the spring band of rubber; *M* a plate, also of cast iron, bored and faced the same as the other, and *J* two jam nuts to adjust the tension on the blank in order to get a smooth job. *K K* were the gage and stripper pins (of which there were three), for gaging and stripping the metal from the punch.

The punch *A* was a forging, the stem of machine steel and the punch proper of tool steel, turned and finished as shown, hardened and drawn, and ground to just fit the blanking die. The blank holder *C*

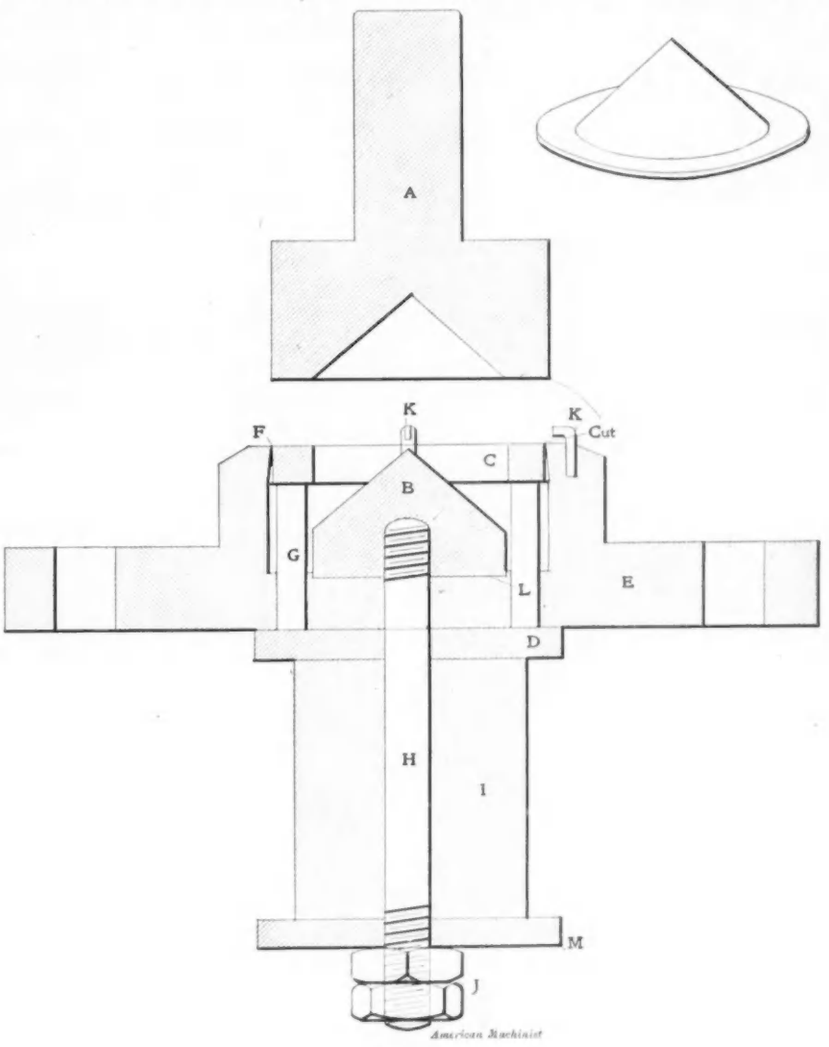


Fig. 1

DRAWING DIE FOR A CONICAL PIECE.

was also hardened, and its face and the face of the punch lapped together in order to hold the blank snugly all around. After the forming die *B* was hardened the parts were assembled as shown, and the die was ready for its work, which it did to the satisfaction of all concerned.

Jos. V. Woodworth.

Brooklyn, N. Y.

The Swelling of Cores.

Editor American Machinist:

In your issue No. 19, Mr. Willard objects to the criticisms, by myself and others, on his article on core swelling, in which he says: "We all know that a core, after being turned out and dried, will not go back into the corebox." We know nothing of the kind, for I have seen a core of his description and size, with the four pins, properly made, dried and put back in the same corebox, and have found the center distances between pins exactly the same after the core was taken from the box and dried. Of course this cannot be done with a heavier type of core; but we have a drill press table which is cored out with a core similar to the one illustrated, only much larger, being about 30 inches square and 30 inches deep. There are four cone prints on the drag side of the pattern, about 2 inches diameter on the small end, and the distances between the centers on pattern and corebox are exactly the same, and we have never had any complaint about the core settling, notwithstanding the fact that a large number of these tables are made. The prints are about 1-16 inch larger in diameter than the core, to allow for the easy entering of the same. A core of this size will, after being turned out of the box, swell but little on the side that is next to the plate upon which it is turned out, but the swelling will begin several inches from the plate, and it will be found that the core will be larger about halfway from the bottom than at any other point. Certainly there is a difference in the sand used by different shops, but such has been my experience.

Mr. Willard's sketch of the pipe, and his argument for allowing half shrinkage on the corebox and full shrinkage on the pattern are absurd, and I agree with "Hobo," that should the pattern foreman place the pattern on the corebox to compare the center distances between the prints, and should he find half shrinkage on corebox and full shrinkage on pattern, it would be the "cue for the patternmaker to pack up and get," especially if it was a good sized job.

I have made pipe patterns much larger than the one illustrated, and have always allowed the same shrinkage on pattern and corebox, and have never found any difference when placing in the mold. My opinion on this matter remains the same, for "what my eyes see does not deceive me."

Louis Baden.

Niles Tool Works.

Rear Driving for Automobiles.

Editor American Machinist:

The article on "Rear Driving for Automobiles," by Mr. Krarup, in the "American Machinist," No. 18, has been read with interest, and it seems to demand an answer.

At this stage of the automobile business, when so much is theory and ignorance, erroneous information should be headed off as quickly as possible. The writer has been building automobiles since 1891, and has been a builder and user of bicycles and tricycles for more than twenty years. During this time the steering problem has been experimented with in every conceivable manner. Rear steering tricycles for one and two people, both two and three trackers, were made by the writer, and their good and bad points determined. If there is any conservation of energy by the use of a different steering that fact would have been apparent in a man-driven machine and the valuable point retained. As a matter of fact, the fastest and easiest running cycles are front steerers, and carry the weight well on the rear wheel.

Mr. Krarup gives us six points which he characterizes as "almost incontestable," the first being "waste of power at turns." If he will kindly reverse the supposed direction of his vehicle, he will readily see that the same power is required to drag the steering wheels at an angle to the line of progress as is required to *push* them at this angle, and if he will remember that in order to turn to the right with a rear steerer he must first turn his rear wheels to the left, he can readily see that the steering wheels must be at an angle to the driving wheels much longer than is the case with a front steerer, which, of course, means a proportionately greater loss of power, and he will further see that his vehicle is carried by the steering wheels partly to the left in order that it may proceed to the right, which carrying is, of course, a further loss of energy.

The second point, pertaining to stresses on pivots, hubs, spokes, rims and tires, may be answered by the same diagram, particularly in cases where it is desired to get the vehicle out of car tracks, in which case it is necessary to force the steering wheels from the car tracks to the left and finally run them back across the track as the vehicle passes to the right. The argument as applied to car tracks holds equally good for any rough or rutty roads, and not only do the rear wheels receive greater strain than they would if front wheels, but they transmit more vibration to the body. Further, it being true that in order to steer the vehicle the rear wheels must be moved in the opposite direction, it is readily seen that there is perhaps twice as much necessary variation in rear steering wheels as there would be in front, and since each variation in direction is a loss of power, the comparison is wholly in favor of the front steerer. If anyone denies this statement regarding steering, he will kindly undertake to ride a bicycle backwards, when he will find that the steering is so difficult as to be impracticable, although quite possible.

The third point is based on the first two, and since they are fallacious it falls to the ground.

The fourth point must be admitted, for, with either style of vehicle, if the front end gives way an upset is probable, while if the rear end gives way it is more likely to drag. This point, however, has no relation to front or rear steering, except that Mr. Krarup assumes front steerers to be more likely to break down in front. As a matter of fact, if the vehicle is properly proportioned neither one need be more likely to break down than the other. Our experience with front steerers and rear driving motor vehicles, covering nearly a decade, has been that more rear wheels are broken than front ones. This fact had been due to having greater loads on the rear wheels.

The fifth point, that of the backward somersault, is one of the exceptions that proves the rule. The only instance in the United States, as mentioned by Mr. Krarup, being, so far as the writer has been able to learn, a case of putting on the brake and power suddenly while the vehicle was running backwards, in which case it was the exact counterpart of a rear steerer and front driving, so that its action may be taken as an exact illustration of what will happen with front drivers carrying a large load on the front wheels and being stopped suddenly by application of the brake or by striking obstacles. This form of upsetting was very common in the days of the high bicycle, and occurred with great frequency in going down hill or in striking a small obstacle on the level. It may be argued that more weight on the rear would obviate this difficulty, but any old bicycle rider knows, and anybody else can easily determine by test, that to be able to climb all reasonable hills a large portion of the weight must be on the driving wheels. It is on this account principally that the high bicycle went out and the safety, the rear driver, came in; and the same law applies to motor vehicles, and will determine the final form, regardless of pages of argument on the subject.

A motor vehicle, to be able to traverse slippery hills, must have very nearly all its weight on its drivers, a sufficient amount being on the steering wheels to insure that the motor cannot lift the front end of the vehicle. Duryea vehicles have been built for the past three years for two and four people, carrying without passengers less than 200 pounds on the front tires. They have been driven up grades as steep as 25 per cent. through snow up to their bodies, through stiff mud as deep as 10 inches, and although it has been possible to jerk the front wheels off the ground by a sudden application of power, there has never been sufficient momentum

in the flywheel to overcome the inertia of the body and passengers and cause an upset. It is readily apparent that a vehicle could be made light enough in front and with power sufficient to lift the front end and upset the vehicle, but proper designing avoids this danger, as is shown by our experience above stated. Upsetting forward with a front driver, however, cannot be overcome by proper designing, and is a matter dependent upon obstacle and brake, one of which is outside the vehicle and not under the control of the designer, and the other, being a friction apparatus, may be made to work with greater than predetermined power, or may be applied in a manner more powerful than common.

A further thought in connection with the brake is that if applied to the front wheels with sufficient power to stop them, the momentum of the vehicle throws the entire weight of the vehicle forward on to the wheels and causes an upset, while with a rear driver, having the brake applied to the drivers, the momentum takes the weight off the driving wheels and allows them to slide under the action at the brake without danger. Anybody can easily experiment with this matter by applying a brake to a bicycle. If it is a front wheel brake and applied with sufficient power to slip the wheel, the bicycle will take a "header." But if a rear wheel brake, the braked wheel simply slides, the forward wheel rolls and no damage results. This is the only safe and practical arrangement for a motor vehicle for all around service.

The sixth point, of constant jarring, vibration of front wheels, mental and physical strain upon the driver, etc., is another case of sheer nonsense, as anyone may find by attempting to steer a front driver at high speeds. By considerable effort it is possible to get along with a rear steerer at slow and moderate speeds, but nowhere in the history of automobilism can be found speedy vehicles steering from the rear. As the speed increases the mental and physical effort to turn the rear wheels first in the reverse direction and then in the right one, in order to steer the front end of the vehicle, becomes so great that it cannot be accomplished. This in itself is sufficient proof that it always requires more effort to steer a rear steerer than a front one. The matter of vibration is a mechanical detail just as easily overcome in one style of vehicle as in the other, if we assume the respective loads on the steering and driving wheels to be the same in both cases, with, as above stated, the difference in favor of the front steerer, due to the fact that rear steerers must cross the car tracks twice to get out once.

If Mr. Krarup has any observations "to illustrate the peculiar unfitness of the rear driving system" that are more potent than those given, the writer would be pleased to see them, but unless he has, the facts are against him, and "facts are stubborn things."

CHAS. E. DURYEA.

Reading, Pa.

Cuban Tariff.

The new Cuban tariff, which is to go into force June 15, imposes upon machinery generally a duty of 20 per cent. ad valorem. This includes engines, boilers, dynamos, sewing machines, and most not otherwise specified. The duty on agricultural, sugar and brandy machinery and apparatus, however, is only 10 per cent. ad valorem. All railway appliances when imported direct by a steam or street railroad, and machinery for the use of planters when imported for the exclusive use of a planter, shall be entitled to entry at a universal duty of 10 per cent. ad valorem during twelve calendar months following the inauguration of the tariff. The importations in those cases to be made under such conditions and guaranty as the Collector of Customs for Cuba may exact or direct.

A.

The Famine in India.

The colossal catastrophe which has befallen the people of India has led to the formation in this city of a Committee of One Hundred to solicit and forward contributions. This committee contains many of the best-known names in the city, and it has probably perfected the best private organization for the purpose ever seen. The express companies, the telegraph companies and the New York banks have all volunteered free services, and newspapers throughout the country are receiving and forwarding funds to the committee. We have been asked to aid in this capacity, and we shall be glad to receive and forward any contributions which our friends may make to the fund.

The famine area equals New England, New York, New Jersey, Pennsylvania, Ohio, Indiana, Illinois, Michigan and Wisconsin combined, and it is estimated that, without aid, ten millions of human beings will die of starvation. Meanwhile five cents a day will save a life.

Personal.

James Hartness returned home June 2, after three months' absence in Europe. His trip included England, France, Germany and Holland, and combined business with pleasure.

E. W. Naylor has resigned his position with the Pennsylvania Iron Works Company and has resumed his practice as consulting engineer at 1,503 North Fifty-second street, Philadelphia. He will make a specialty of hydraulic machinery.

L. H. Flanders, who has been an instructor in the mechanical laboratory of the Armour Institute of Technology, Chicago, has accepted a position in the gas engine testing department of the Westinghouse Machine Company, Pittsburgh.

Jos. W. Bramwell, engineer and expert in testing machinery, editor of "Digest of Physical Tests," has severed his connec-

(Continued on page 42.)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 20.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

You furnish the rough ideas; we develop them. Address B. A. L., Box 73, AM. MACH.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, Pa., build light machinery.

Selden Packing for Stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

Wanted—To rent, a machine shop to employ 10 machinists; gas belt preferred. Address Box 62, AMERICAN MACHINIST.

For Sale—One 11x18 Buckeye engine, as good as new; in use 19 months. Address the Cincinnati Milling Machine Co., Cincinnati, O.

Threads and gears; easy rules to cut any thread possible to be cut in the lathe, without algebra, sent to any address for 25c. by G. W. Dixon, Spring Lake, Mich.

For Sale—Well-equipped bicycle and general repair shop, with power; sporting-goods store connected; established 13 years; in New England. Address Box 94, AMER. MACH.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

A successful machine-shop foreman is open for engagement. Box 71, AMER. MACHINIST.

First-class mechanical draftsman wants to change position. N., care AMER. MACHINIST.

Experienced draftsman, technical graduate, desires position for July and August. Box 68, AMERICAN MACHINIST.

Wanted—Position by pattern-maker foreman; good reason for making change. Address Box 83, AMERICAN MACHINIST.

Foreman, competent to design metal-working machinery, tools, jigs, etc., wants charge of a Western shop. Box 84, AMER. MACH.

Mechanical draftsman, 10 years drawing room and shops; special and automatic machinery; near New York. Box 70, A. MACH.

Foundry foreman open for engagement; capable and efficient; floor work or machine molding. Address Wm. H. Sickels, 254 Bond st., Elizabethport, N. J.

Superintendent, with 20 years' experience in light metal manufacturing of interchangeable parts, wishes to make a change. Box 86, AMERICAN MACHINIST.

Situation wanted by tool and die maker, accustomed to interchangeable work; expert in hardening; city or country. Address Box 82, AMERICAN MACHINIST.

Machinist, first-class, all-round man, some experience as foreman, would like position with reliable firm in any capacity; references. Box 72, AMERICAN MACHINIST.

Wanted—Position as foreman, by first-class toolmaker and machinist; experienced on fine machinery, dynamos, tools; best references. Address Box 65, AMERICAN MACHINIST.

A practical foreman and superintendent, with 25 years of experience in engines, dynamos and general machine-shop work, desirous of position. Address Box 85, AMER. MACH.

Experienced toolmaker, who has recently lost left hand, wishes position as inspector or

(Continued on page 42.)

(*Continued from page 41.*)

tion with the Riehle Company, and in future will be identified with the Philadelphia Machine Tool Company, where he will personally design and superintend the manufacture of testing machinery, in addition to the extensive line of presses, drop hammers, etc., this firm manufactures.

The American Foundrymen's Association, at its recent meeting in Chicago, elected the following officers for the ensuing year: President, W. A. Jones, Chicago; secretary, Dr. R. G. Moldenke, Pittsburgh; treasurer, Howard Evans, Philadelphia; vice-presidents, G. B. Buckingham, Worcester, Mass.; William Yagle, Pittsburgh; J. P. Golden, Columbus, Ga.; J. A. Penton, Detroit; William Ferguson, Chicago; W. S. Mosher, Dallas, Texas; R. Chartrey, San Francisco, and T. J. Bast, Montreal.

Technical Publication.

"Standard Designs for Boats of the United States Navy, Specifications, Schedule of Material, Weights and Cost." Chief Constructor Philip Hichborn, U. S. N. Washington, Government Printing Office.

This is a costly and imposing volume, having to do entirely with the small boats of the Navy, whether propelled by oars, by sails, or by steam. It is 15 x 13 inches, and 2 inches thick. There are 96 pages of text and 222 full-page plates. Every detail of each class of boats is given, with also excellent half-tones of each complete. The book is a monument to the thoroughness of the work of the Bureau of Construction and Repair, and it should be a prize to every boat builder who is able to obtain it.

New Catalogs.

The Brown Hoisting & Conveying Machine Company, Cleveland, O., sends a pamphlet describing its standard tubs and buckets. Size, standard, 6x9 inches.

The Bullock Electric Manufacturing Company, Cincinnati, O., sends us a little pamphlet in English and French, with views of different departments of its works and of its machines on exhibition at the Paris Exposition, for distribution at which the pamphlet is intended. Size, 3½x6 inches.

The Standard Pneumatic Tool Company, Chicago, has published a Paris Exposition special edition catalog of its products. There are many illustrations showing these tools and appliances—the "Little Giant"—some of which were recently placed on the market, and the way in which they are used. Size, 9¼x6 inches.

The Waterbury (Conn.) Machine Company sends Catalog "B" of wire-drawing machinery. (Catalog "A" of this series relates to power presses and "C" to special machinery.) It shows an extensive line of machines for rod drawing and wire manufacture. In the back are some tables of gages and weights of wire, etc. Size, 5½x7 inches.

The Crosby Steam Gage & Valve Company, Boston, Mass., has published a substantial

(*Continued on page 43.*)

Situations Wanted—Cont'd.

in charge of work; thoroughly competent and can give best references. Box 95, AM. MACH.

Purchasing agent, correspondent and general office man; has had the advantage of shop and drawing-room training; at present with machine-manufacturing concern. Address "Manager," AMERICAN MACHINIST.

Position wanted as superintendent, engineer, general foreman, chief draftsman, designer or erector; my specialty is power plants in all branches; age 40; American; experience, education and references. Address Box 49, AM. M.

Owing to consolidation, a practical, progressive mechanical superintendent desires engagement; executive ability; experienced interchangeable work, machine tools, etc. Address Superintendent, P. O. Box 1533, New York.

Mechanical superintendent desires to make a change; capable of taking entire charge of works; experienced on electrical machinery of all sizes, steam engines, boilers, mining machinery, pumps, etc.; thoroughly practical; good draftsman and designer; member of A. S. M. E. Address Box 60, AM. MACH.

Wanted—Position as superintendent with first-class manufacturing concern, by a practical, all-round machinist, 43 years of age; 28 years' experience in manufacturing plumbers' brass and iron goods, electrical motors, generators, switchboards, controllers and all classes of electrical appliances; up to date in all modern shop practice and good business methods; 20 years as a successful superintendent, with A1 references. Address "Technical," care AMERICAN MACHINIST.

Help Wanted.

Wanted—First-class, all-around machinists. Gifford Bros., Hudson, N. Y.

Wanted—First-class machinist as foreman of lawn mower works. Address Box 87, AM. M.

A machinist in every shop to handle my calipers and levels; liberal inducements. E. G. Smith, Columbia, Pa.

Wanted—A pattern maker to teach woodworking in a Southern college. Address C. W. S., 510 E. Front st., Plainfield, N. J.

Draftsman wanted, who is familiar with marine deck fittings; state experience and wages expected. Box 90, AM. MACHINIST.

Draftsmen, machinists, toolmakers, desiring extra money, state where employed, confidential. Edwin Guthrie, Corcoran Building, Washington, D. C.

Wanted—Good machinists; applicants will please state what their experience has been and wages expected. American Ship Windlass Co., Providence, R. I.

Wanted—A young man of some teaching experience, to teach mechanical drawing in a Southern college. Address C. W. S., 510 E. Front st., Plainfield, N. J.

Wanted—Machinists; two or three good turners who can oversee a few others, for which extra pay will be given. Address C. M. W., AMERICAN MACHINIST.

Wanted, at Once—Foreman of wide experience for machine shop producing large direct-current dynamos and motors; good salary for the proper person. Box 78, AMER. MACH.

Wanted—Draftsman; a young man familiar with the designing of jigs, tools, fixtures and special machinery; in answering state references, also wages wanted. Box 89, A. MACH.

Draftsman wanted; an experienced man on steam engine and air compressors; location in Middle States. Write, stating age, experience and salary required, to Box 43, A. MACH.

Wanted—A first-class Corliss Engine man; one who is familiar with the adjustment of Corliss gears and governors; technical man preferred; state experience. Box 75, AM. M.

Experienced draftsman wanted on mill machinery and machine tools; permanent employment assured to rapid and accurate draftsman. Bethlehem Steel Co., South Bethlehem, Pa.

Wanted, at Once—Foreman of wide experience for winding department of factory producing large direct-current dynamos and motors; good salary for the proper person. Box 79, AMERICAN MACHINIST.

Wanted—Three first-class toolmakers on small interchangeable tools and automatic machinery; factory nearby city; state age, experience and wages expected. Address Box 77, AMERICAN MACHINIST.

Boiler Makers.—Wanted—Foreman boiler maker, one with ability to lay out work and handle men advantageously; permanent position, with good salary to competent man. Address Box 76, AMERICAN MACHINIST.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite application from pat-

(*Continued on page 43.*)

VALUABLE BOOKS

JUST OFF THE PRESS.

Gas Engine Construction

A Practical Treatise Describing in Every Detail the Actual Building of a Gas Engine.

By HENRY V. A. PARSELL, Jr., Member A. I. Electrical Engineers, and ARTHUR J. WEED, M.E.

Large 8vo. Very fully illustrated. 300 pages. Handsomely bound in cloth.

PRICE, $2.50.

This book treats of the subject more from the standpoint of practice than that of theory. The principles of operation of Gas Engines are clearly and simply described, and then the actual construction of a half-horse power engine is taken up, step by step, showing in detail the making of a Gas Engine.

First come directions for making the patterns; this is followed by all the details of the mechanical operations of finishing up and fitting the castings. This is profusely illustrated with beautiful engravings of the actual work in progress, showing the modes of chucking, turning, boring and finishing the parts in the lathe, and also plainly showing the lining up and erection of the engine.

Dimensioned working drawings give clearly the sizes and forms of the various details.

The entire engine, with the exception of the fly-wheels, is designed to be made on a simple 8-inch lathe, with slide rest.

The book closes with a chapter on American practice in Gas Engine design and gives simple rules so that anyone can figure out the dimensions of similar engines of other powers.

☞ Every illustration in this book is new and original, having been made expressly for this work.

—ALSO—

An American Book on

Horseless Vehicles, Automobiles, AND Motor Cycles.

Operated by Steam, Hydro-Carbon, Electric and Pneumatic Motors.

By GARDNER D. HISCOX, M.E.

Author of "Gas, Gasoline and Oil Engines" and "Mechanical Movements, Powers, Devices and Appliances."

Large 8vo. 459 pages. 346 illustrations. Handsomely bound in cloth.

PRICE, $3.00.

A Practical Treatise for Automobilists, Manufacturers, Capitalists, Investors, Promoters, and everyone interested in the development, care and use of the Automobile.

This work is written on a broad basis, and comprises in its scope a full description with illustrations, and details, of the progress and manufacturing advance of one of the most important innovations of the times, contributing to the pleasure and business convenience of mankind.

The makeup and management of Automobile Vehicles of all kinds are very liberally treated, and in a way that will be appreciated by those who are reaching out for a better knowledge of this new era in locomotion.

This book is up-to-date and very fully illustrated with various types of Horseless Carriages, Automobiles, and Motor Cycles, with many details of the same.

It also contains a complete list of the Automobile and Motor Manufacturers with their addresses, as well as a list of patents issued since 1856 on the Automobile industry.

☞ A special and detailed illustrated circular of these two books mailed on request.

Gas, Gasoline and Oil Engines.

By GARDNER D. HISCOX.

Third Edition, revised and much enlarged. 365 pages. Large octavo. Illustrated with 270 handsome Engravings.

PRICE, $2.50.

Full of general information about the new and popular Motive Power, its economy and ease of management. Also chapters on HORSELESS VEHICLES, ELECTRIC LIGHTING, MARINE PROPULSION, etc.

Mechanical Movements,

Powers, Devices and Appliances.

By GARDNER D. HISCOX.

Large 8vo. 402 pages. 1649 illustrations, with descriptive text.

PRICE, $3.00.

A Dictionary of Mechanical Movements, Powers, Devices and Appliances, embracing an illustrated description of the greatest variety of mechanical movements and devices in any language. A new work on illustrated mechanics, mechanical movements, devices, appliances, etc., etc.

☞ We publish a line of books for Machinists, Mechanics, Inventors, Engineers, Draftsmen, Students, and all practical trades, and will send our catalogs to any one, in any part of the world, free on request.

☞ Any of the above books sent free to any part of the world on receipt of price.

NORMAN W. HENLEY & CO.,

15 Beekman St., NEW YORK.